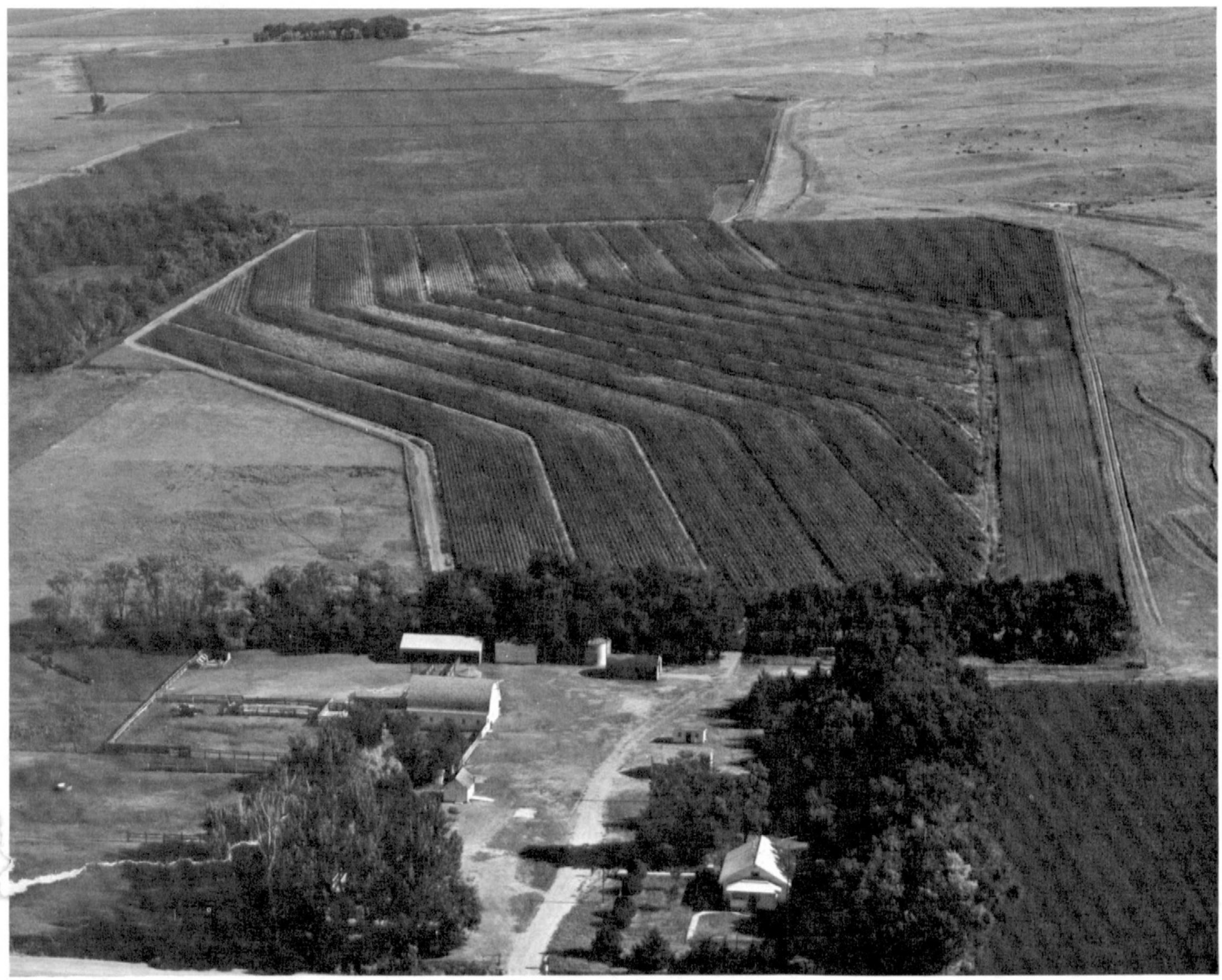
United States
Department of
Agriculture

Soil
Conservation
Service

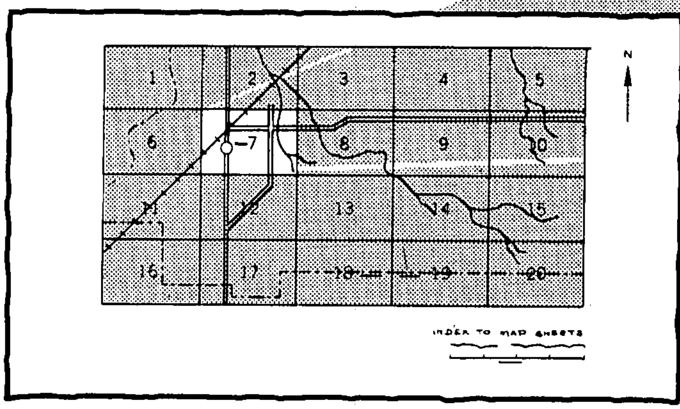
In cooperation with
Conservation and
Survey Division,
University of Nebraska

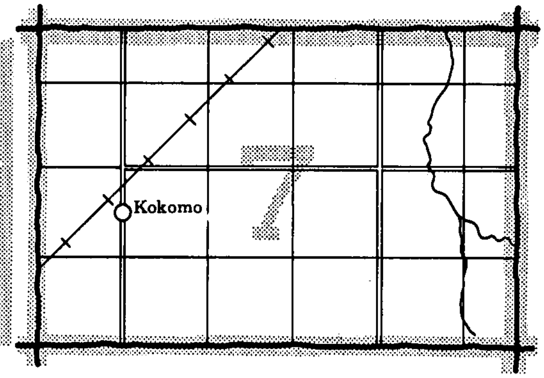
Soil Survey of Chase County Nebraska



HOW TO USE

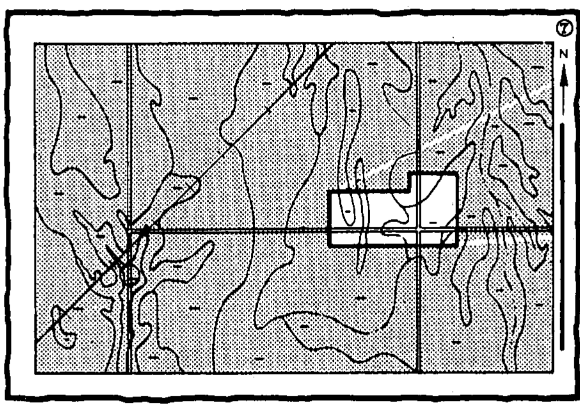
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

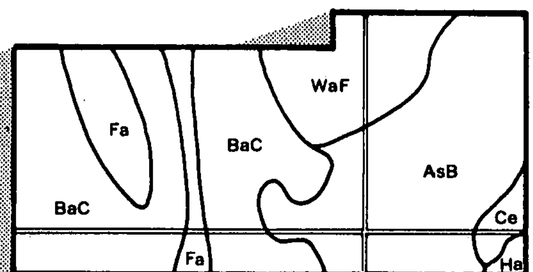




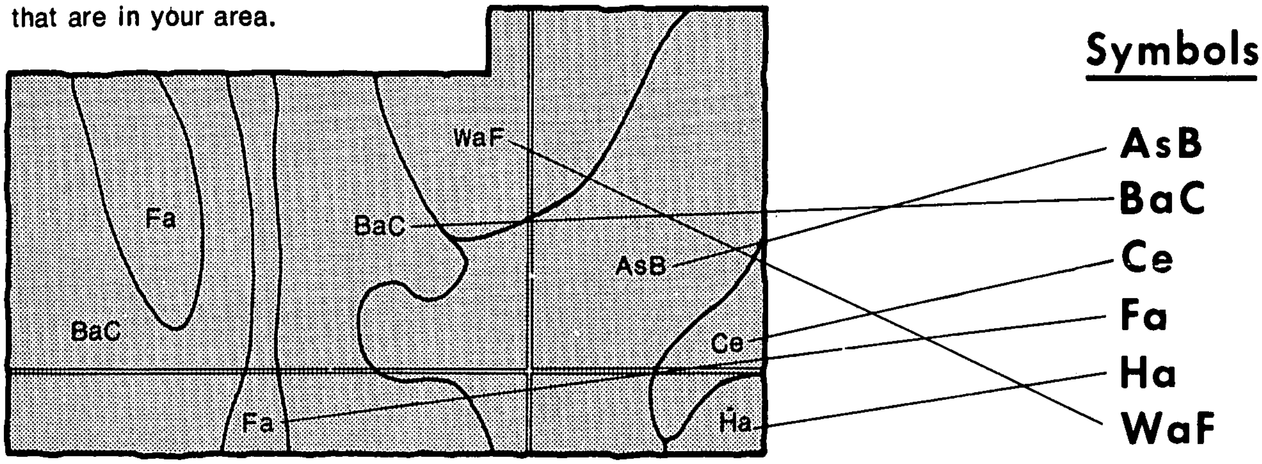
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



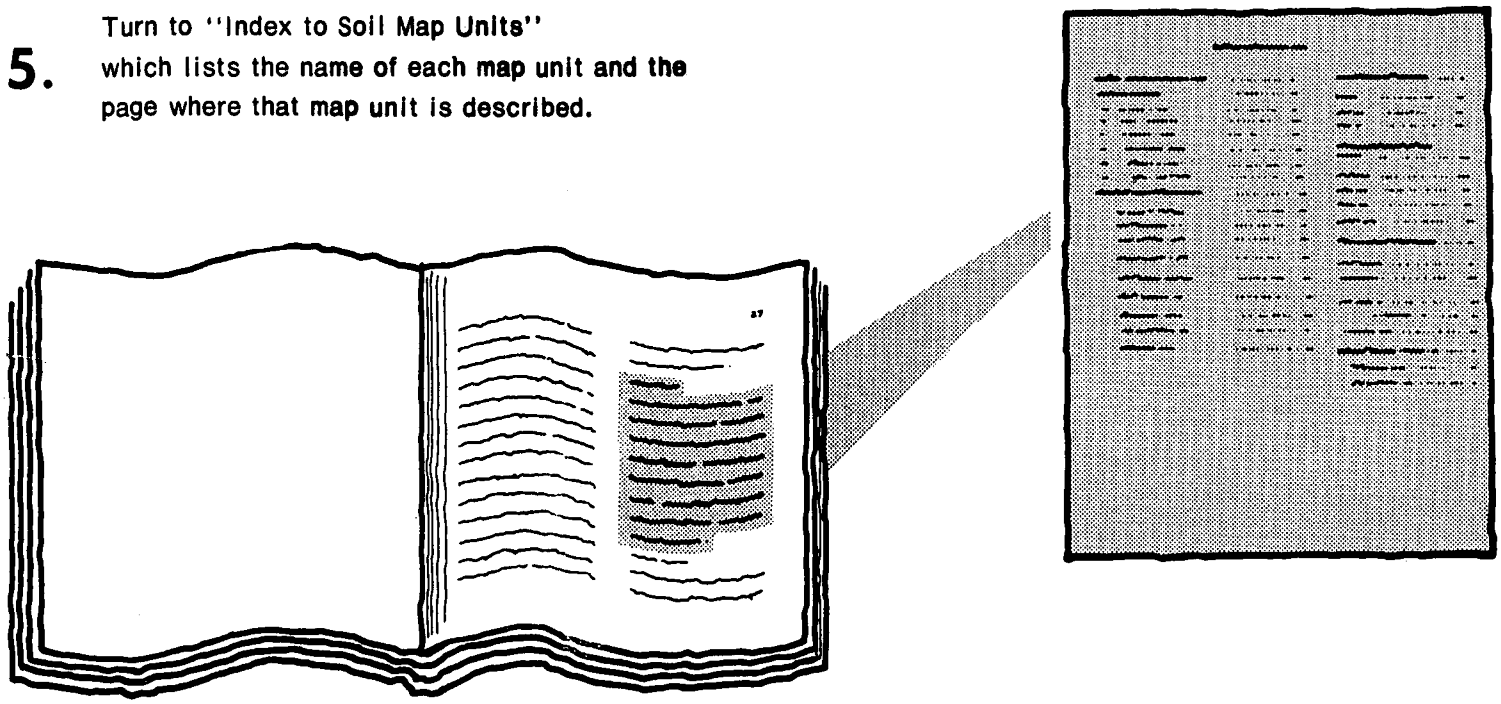


4. List the map unit symbols that are in your area.

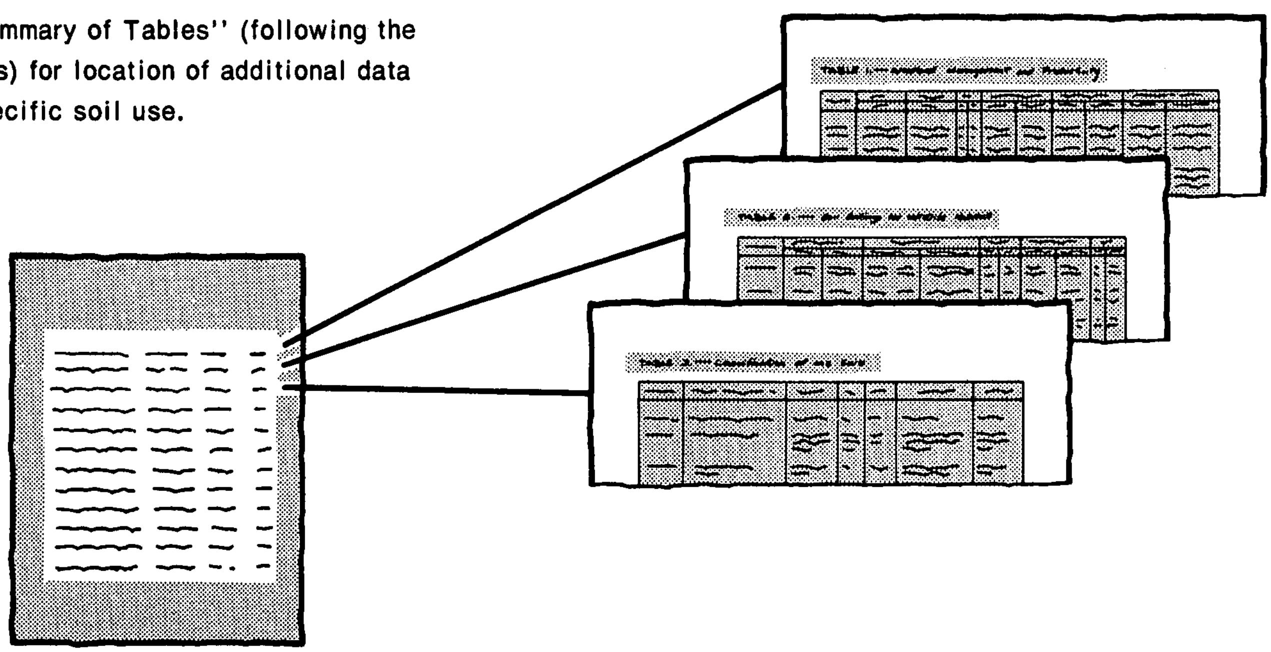


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; to specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies and state agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

This survey was made cooperatively by the Soil Conservation Service and the University of Nebraska, Conservation and Survey Division. It is part of the technical assistance furnished to the Upper Republican Natural Resource District. Major fieldwork was performed in the period 1974-1980. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

This soil survey supersedes a soil survey of Chase County published in 1919.

Cover: The farmstead windbreak, contour bench gravity irrigation system, and diversion terraces are in an area of the Colby association. The nearly level fields beyond and on the left are in an area of the Gannett-Wann-Gibbon association.

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soil series

Issued November 1982

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foreword

This soil survey contains information that can be used in land-planning programs in Chase County, Nebraska. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service.

A. E. Sullivan

Albert E. Sullivan
State Conservationist
Soil Conservation Service

soil survey of
Chase County, Nebraska

By Harry Paden, Soil Conservation Service,
and Dave Loges and Randall Stapes, University of Nebraska

United States Department of Agriculture, Soil Conservation Service
in cooperation with Conservation and Survey Division,
University of Nebraska

CHASE COUNTY is in the southwestern part of Nebraska (fig. 1). It adjoins Colorado on the west, Hayes County on the east, Dundy County on the south, and Perkins County on the north. The total area is 572,160 acres, or 894 square miles. The distance from east to west is slightly more than 37 miles, and from north to south it is 24 miles.

The population of Chase County was about 4,750 in 1978. Imperial and Wauneta are the only incorporated towns in the county. Imperial is the county seat and has a population of about 1,800. It is located near the center of the county on U.S. Highway 6 and State Highway 61, about 290 miles west of Lincoln. Wauneta has a population of about 800. It is located in the Frenchman Creek valley, 20 miles southeast of Imperial on U.S. Highway 6. Both towns are served by a branch line of the Burlington Northern Railroad. Champion, Enders, and Lamar are small communities. U.S. Highway 6 crosses the county from east to west. State Highway 61 runs across the center of the county from north to south.

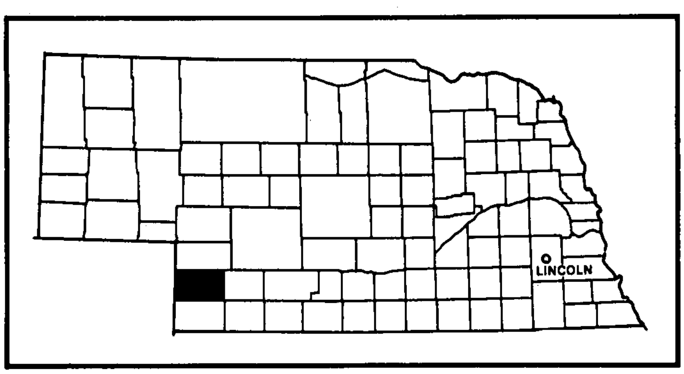

Figure 1.—Location map of Chase County in Nebraska.

Agriculture is the main source of income in Chase County. Farming, ranching, and related businesses account for most of the employment. Some farms combine cash-grain farming and livestock raising. Corn, winter wheat, sugar beets, pinto beans, and alfalfa are the main crops. In 1978, about 50 percent of the land area was cropland and about 45 percent was rangeland. Farmsteads, towns, and other uses took up the rest. In 1979, according to data obtained by the Upper Republican Natural Resources District, about 58 percent of the cropland was irrigated.

Rangeland is a part of most farms in the county. The strongly sloping to very steep soils and most of the sandhills remain in native grasses and are used as rangeland for beef cattle herds. The silty and loamy soils that are nearly level to gently sloping are used mainly as cropland.

Four water impoundment reservoirs store water within Chase County. All of these impoundments are on Frenchman Creek. The largest, Enders Reservoir, has a surface area of about 1,420 acres. Reservoir Lake has a surface area of about 90 acres, Reservoir Pond about 50

acres, and Champion Mill Pond about 10 acres. Champion Mill Pond is a state recreation area. Reservoir Lake and Enders Reservoir provide water for irrigation. A number of permanent residences have been built around Enders Reservoir.

Most of the soils in Chase County are on uplands. Some are sandy soils that formed in eolian sand. Others are silty and loamy soils that formed in loess and loamy eolian material. Soil blowing and water erosion are the main hazards. Insufficient rainfall for crops is a concern in most years. Conserving water and maintaining fertility are major concerns in management. Proper design of irrigation systems and efficient use of water are important concerns.

The soils along Frenchman, Spring, and Stinking Water Creeks formed in alluvial and colluvial material. Occasional flooding and wetness from a seasonal high water table are hazards on some of these soils. Controlling soil blowing and maintaining tilth and fertility are important concerns in management.

general nature of the county

This section provides information about Chase County. It discusses history and development; physiography, relief, and drainage; climate; geology; and ground water.

history and development

The area that is now Chase County was initially prairie. The Indians who lived in the area belonged to three different tribes of nomadic hunters: Sioux, Comanche, and Pawnee. The first white people to use the land for agriculture were cattlemen. Nutritious grasses on free open range supplied good forage in summer and winter, and the steep canyons afforded shelter from winter storms. Water was available at all seasons along the larger streams.

The boundaries of Chase County were established by an act that was approved on February 27, 1873 (*5*). The county was organized in 1886. It was named for Colonel Champion S. Chase, a former mayor of Omaha and the first state attorney general. Settlement was slow at first and was mainly limited to trappers and cattlemen. In 1886, settlers began to arrive in large numbers. These settlers generally built their houses and towns along the major streams. Champion, the first town built in the county, was located on Frenchman Creek so as to utilize the abundant water. A water mill was erected on Frenchman Creek for use in converting grain into flour and feed.

The first settlers came to Chase County to set up cattle ranches. Later settlers who came to farm the land acquired their land through homestead claims and tree claims. Tree claims were established by planting and maintaining a specified number of trees on the land. The settler could then claim the land for his own. In 1917, about 20 percent of Chase County was under cultivation. Corn was the leading crop with about 48,564 acres planted. Wheat was the second largest crop with about 28,123 acres planted. In 1917, only a small acreage of cultivated land was irrigated. In those early years, crops often failed because of drought (*7*).

Prior to the 1940's, crops had been irrigated by water diverted from streams. Around the turn of the century, a small irrigation canal was built a few miles west of Champion to divert water from Frenchman Creek into Reservoir Lake and then to surrounding fields for irrigation. This canal is still used. Water for irrigation is pumped directly from Frenchman Creek, Spring Creek, and Stinking Water Creek by a few farmers. Deep wells supply the greatest amount of irrigation water. On January 1, 1966, there were 212 registered wells for irrigation purposes in Chase County. These wells irrigated an estimated 26,000 acres in 1965. As of January 1, 1979, there were 1,162 registered wells irrigating an estimated 155,000 acres. In 1979, there were about 850 center pivot irrigation systems in Chase County. Other irrigation systems in use were gravity systems and various types of sprinkler systems.

physiography, relief, and drainage

Chase County is in the Central Plains section of the Great Plains physiographic province. Most of the county is in the Central High Tableland Land Resource area of Nebraska (*3*). The Rolling Plains and Breaks Land Resource area extends into the southeastern part of the county.

The topography of Chase County generally consists of plains that have been modified by wind and stream erosion and deposition into high divides or tablelands that are separated by valleys.

About one-third of Chase County is covered by sandhills, mainly throughout the northeastern, north-central, central, and southwestern parts of the county. The topography of these sandhill areas varies from choppy hills to depressions and flats. There are valleys of varying sizes among the sandhills. The soils in the valleys are for the most part finer textured than the soils on the surrounding sandhills and generally are suited to cultivated crops.

In the northwestern part extending into the central part and in the south-central part of the county, the surface is nearly level except for a few well defined intermittent drains that are bordered by strong slopes.

The valleys of the Frenchman, Spring, and Stinking Water Creeks are broader, and their side slopes are dissected by numerous small canyons and drainageways. Some slopes are steep and nearly bare of vegetation. Rock outcrops in some areas. The valleys of these perennial streams comprise foot slopes, stream terraces, and wet bottom lands adjacent to the stream channels.

There are three main divides or tablelands in the eastern half of the county. The loess plains are in the east-central and southeastern parts of the county. These plains are tablelands made up of nearly level to gently sloping soils. They provide a sharp contrast to the adjacent steep canyons and slopes. In the northeastern part of the county the divide consists of loamy and sandy soils that are nearly level to gently sloping.

Elevation ranges from 2,945 feet at the town of Wauneta to 3,742 feet in the sandhills south of U.S. Highway 6 near the Colorado-Nebraska state line. Imperial, near the center of the county, is at an elevation of 3,284 feet.

Chase County is in the Republican River drainage basin (*4,6*). Much of the county is well drained. The sandhills and the steep slopes are excessively drained, mainly because of the very rapid permeability of the coarse sandy soils on the sandhills. The county is drained by Frenchman Creek and its tributaries, Spring Creek, Sand Draw, and Stinking Water Creek. Frenchman Creek originates in Colorado, but perennial water flow starts several miles inside Chase County. Frenchman Creek flows eastward from Chase County and enters the Republican River in Hitchcock County. Spring Creek and Stinking Water Creek begin in Perkins County but are not perennial streams until they are within Chase County. Spring Creek flows into Stinking Water Creek at the eastern border of Chase County. Stinking Water Creek flows southeast and enters Frenchman Creek in southern Hayes County. The water in these streams comes from ground water seepage and a few springs. Most of this water flows from the Ogallala bedrock that underlies Chase County.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

In Chase County, winters are cold because of incursions of cold continental air that brings fairly frequent spells of low temperature. Summers are hot, but the heat is occasionally dispelled by incursions of cooler air from the north. Snowfall is fairly frequent in winter, but usually the snow cover is not continuous. Rainfall is heaviest late in spring and early in summer. Annual precipitation normally is adequate for wheat, sorghum, and range grasses.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Imperial, Nebraska, in the period 1951 to 1973. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 30 degrees F, and the average daily minimum temperature is 17 degrees. The lowest temperature on record, which occurred at Imperial on March 3, 1960, is -24 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred at Imperial on June 29, 1963, is 107 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 19 inches. Of this, 15 inches, or 80 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 12 inches. The heaviest 1-day rainfall during the period of record was 4.58 inches at Imperial on April 19, 1971. Thunderstorms occur on about 50 days each year, and most occur in summer.

Average seasonal snowfall is 31 inches. The greatest snow depth at any one time during the period of record was 15 inches. On an average of 18 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 50 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the northwest. Average windspeed is highest, 13 miles per hour, in spring. Severe duststorms occur on occasion in spring, when strong dry winds blow over unprotected soils. Tornadoes and severe thunderstorms, which may also be hailstorms, occasionally occur. These storms are local and of short duration, and the pattern of damage is variable and spotty.

geology

The geologic material at the surface in Chase County is sedimentary and ranges in age from Pliocene (Ogallala Formation) to Recent (alluvium in valleys and on foot slopes).

The oldest material at the surface is that of the Ogallala Formation, which is predominantly weakly consolidated and calcareous silt, sand, clay, and gravel and beds of caliche and limestone. This formation crops out on the valley sides of Stinking Water Creek, Spring Creek, and Frenchman Creek. It is at the surface in a broad belt from south of Champion to the northwestern part of the county and in a narrow belt from north and northwest of Imperial to Enders. Windblown sand mantles the Ogallala Formation in the southwestern corner, in the north-central part, and in parts of central and east-central Chase County. The southeastern part of the county is loess-mantled. The windblown sand and loess are mainly of late Pleistocene age. Material of middle Pleistocene and possibly of early Pleistocene age

crops out on valley sides in southeastern Chase County. In the valleys throughout the county there are recent alluvial deposits of sand, silt, and clay.

On the soil maps, the areas where the Ogallala Formation crops out are associated with Canyon, Duda, Mace, Rosebud, and Tassel soils. Dailey, Jayem, Valent, and Vetal soils are indicative of the areas of windblown sand and Colby, Goshen, Keith, Kuma, and Ulysses soils of the loess-mantled areas. In the areas of recent alluvium, Caruso and Wann soils indicate sandy and loamy alluvium, and Gannett, Gibbon, and McCook soils indicate silty and moderately clayey alluvium.

ground water

Wells throughout Chase County provide water for domestic and livestock use, for municipal use, and for irrigating crops. Most of the water pumped from wells is used for irrigating crops.

Most irrigation wells extend into the saturated sand and gravel of the Ogallala Formation, which is of considerable thickness throughout the county. Generally, wells for irrigation can be sunk wherever needed. A few wells tap alluvial sand and gravel beneath the valleys.

Wells for domestic use and for stock derive adequate quantities of water at a shallow to moderate depth from the sand and gravel beneath the valleys, from the Ogallala Formation, and, in some sandhill areas, from the windblown sand.

Ground water of good quality is available throughout Chase County. The water is of the calcium carbonate type, generally low in sulphates, iron, chlorides, sodium, and boron. It generally is moderately hard or hard. Water from wells is more highly mineralized in the southwestern corner of the county than elsewhere. In that part of the county, the water is higher in total dissolved solids and in sodium and is rated very hard. The sodium content does not present a health hazard to people or livestock, but it is near the level where sodium may accumulate in irrigated soils, and alkalinity problems may develop.

Ground water can be contaminated by drainage from feedlots, septic tanks and other waste disposal systems, and agricultural chemicals and fertilizers. Newly installed domestic wells need to be checked for contamination, and existing wells need to be checked occasionally. Shallow wells are more subject to contamination from surface pollutants than deep wells. Wells in areas of sandy or gravelly soils are more likely to become contaminated than those in areas of silty or clayey soils.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

This soil survey supersedes the soil survey of Chase County published in 1919 (*7*). This survey provides additional information and contains larger maps that show the soils in greater detail.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit, or soil association, on the general soil map is a unique natural landscape. Typically, a soil association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in others but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Deep, sandy soils on uplands

The soils in this group are deep, nearly level to very steep, and excessively drained. Most of the acreage is rangeland and is used for grazing. A small part of the acreage is cultivated. Soil blowing is a hazard if the soil is overgrazed. Keeping the range in good to excellent condition is an important concern in management.

1. Valent association

Deep, nearly level to very steep, excessively drained, sandy soils that formed in eolian sand

This association consists of rolling to very steep sandhills and nearly level to gently undulating valleys between the sandhills (fig. 2). Slopes range from 0 to 60 percent.

This association takes up about 213,528 acres, or about 37 percent of the county. Valent soils make up about 88 percent of this association, and minor soils make up the rest.

Valent soils have a surface layer of grayish brown sand about 4 inches thick. The underlying material is light yellowish brown sand to a depth of more than 60 inches.

The minor soils in this association are mainly Dailey, Duda, Tassel, and Vetal soils. Dailey soils have a grayish brown surface layer more than 10 inches thick. Vetal soils are fine sandy loam throughout and are well drained. Both soils are nearly level or very gently sloping and are in valley swales. Duda and Tassel soils are gently sloping to very steep and are on ridgetops and side slopes. Duda soils are moderately deep, and Tassel soils are shallow over weakly cemented caliche.

Farms in areas of this association are mainly livestock enterprises. The steep and very steep soils are used for grazing. Some of the nearly level to strongly sloping soils are cultivated and irrigated. Corn and alfalfa are the main crops. Sprinkler-irrigated introduced grasses are grown for grazing or mowed for hay. Some livestock is fattened for market.

Soil blowing is a severe hazard. Small blowouts occur where the plant cover is sparse or where there is no plant cover. Maintaining adequate cover to prevent soil blowing is a concern in managing rangeland. Soil blowing and insufficient moisture are hazards on cultivated cropland. Maintaining adequate cover to prevent soil blowing, applying irrigation water frequently and according to need, and maintaining soil fertility are concerns in managing irrigated soils.

Farms in areas of this association on the average are 3,000 acres in size. Water for livestock is pumped from wells by windmills or electric motors.

Deep, loamy and sandy soils on uplands

The soils in this group are deep, nearly level to gently sloping, and well drained. Most of the acreage is irrigated cropland. In a few areas the soils are dry-farmed. Soil blowing is a hazard. Conserving water for plant use, controlling soil blowing, and maintaining fertility are the main concerns in management.

2. Woodly-Jayem-Ascalon association

Deep, nearly level to gently sloping, well drained, loamy and sandy soils that formed in loamy and sandy eolian material

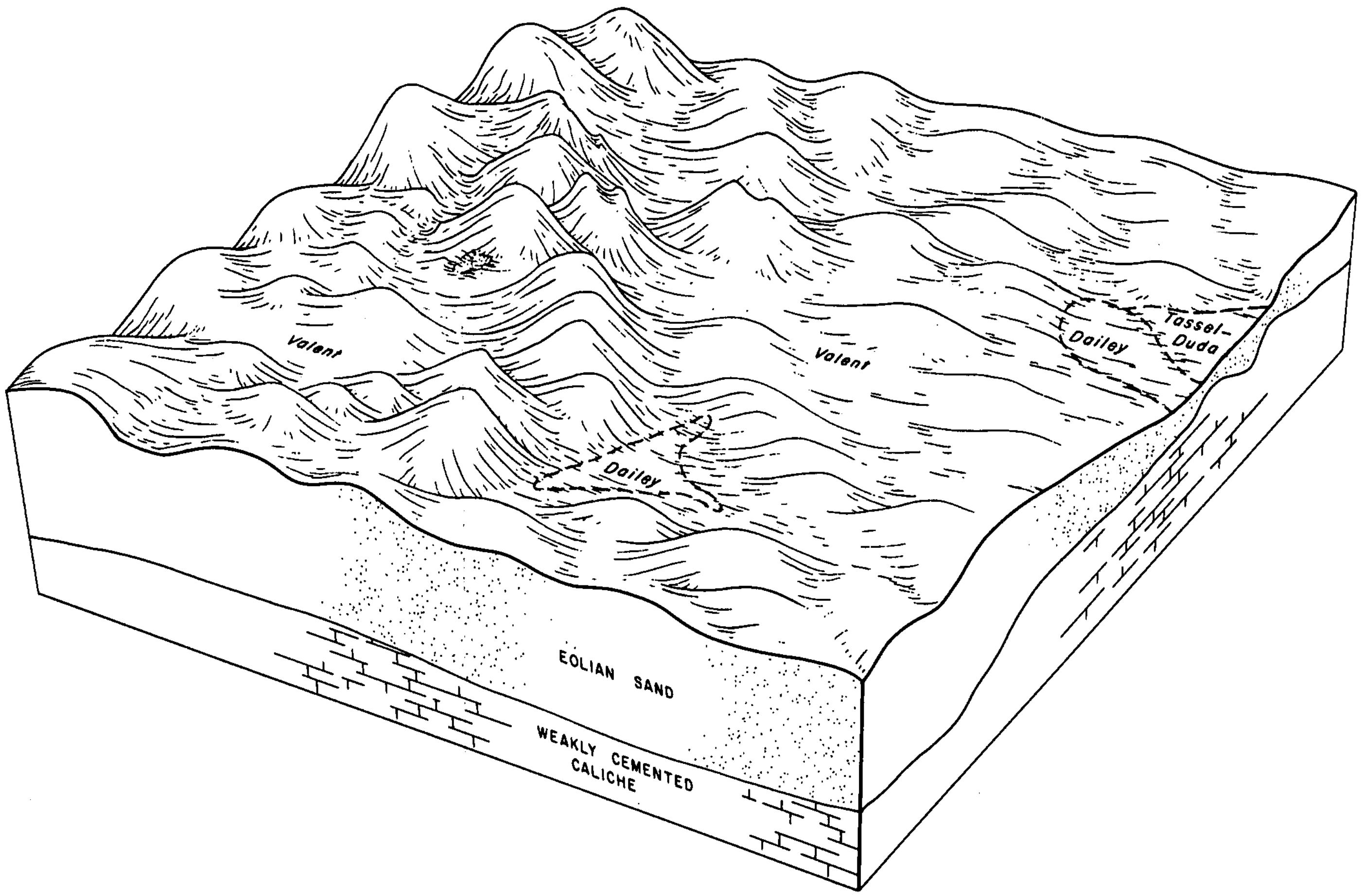

Figure 2.—Typical landscape pattern of the soils and underlying material in the Valent association.

This association consists of nearly level to undulating areas between the sandhills and the loamy uplands (fig. 3). Slopes range from 0 to 6 percent.

This association takes up about 96,910 acres, or about 17 percent of the county. It is about 44 percent Woodly soils and similar soils, 22 percent Jayem soils and similar soils, 19 percent Ascalon soils and similar soils, and 15 percent soils of minor extent.

Woodly soils are nearly level and very gently sloping and are on swells. Typically, the surface layer is grayish brown and dark grayish brown, very friable fine sandy loam about 16 inches thick. The subsoil is about 30 inches thick. It is dark grayish brown, friable sandy clay loam in the upper part and grayish brown, very friable fine sandy loam in the lower part. The underlying material is light gray sandy loam to a depth of more than 60 inches.

Jayem soils are nearly level to gently sloping and are on ridges and side slopes. Typically, the surface layer is dark grayish brown, very friable fine sandy loam or loamy fine sand about 11 inches thick. The subsoil is brown, very friable fine sandy loam about 10 inches thick. The underlying material is yellowish brown fine sandy loam in the upper part and light yellowish brown loamy fine sand in the lower part to a depth of more than 60 inches.

Ascalon soils are nearly level to gently sloping and are on ridges and side slopes. Typically, the surface layer is grayish brown, very friable fine sandy loam about 6 inches thick. The subsoil is about 22 inches thick. The upper part is grayish brown, very friable fine sandy loam. The middle part is brown, friable sandy clay loam. The lower part is pale brown, very friable fine sandy loam. The underlying material is very pale brown very fine sandy loam to a depth of more than 60 inches.

The minor soils in this association are mainly Canyon, Creighton, Laird, Rosebud, and Vetal soils. Canyon soils are shallow and gently sloping to strongly sloping. They

are on side slopes. Creighton soils are nearly level to strongly sloping, are on side slopes, and have lime at a shallower depth than the major soils. Laird soils are nearly level and very gently sloping and are in broad basins between sandhills. Rosebud soils are moderately deep and are nearly level to gently sloping or undulating. They have lime throughout. Vetal soils are nearly level and very gently sloping and are in depressions. They are dark colored to a depth of more than 20 inches.

Farms in areas of this association are mainly irrigated cropland. Corn, sugar beets, pinto beans, and alfalfa are the main crops. The soils are irrigated with water from deep wells, mainly by center-pivot sprinklers. Under dryland management, wheat is the main crop. Some of the acreage is in native grasses and is used as rangeland.

Soil blowing is a hazard, and inadequate rainfall is a limitation under dryland management. Maintaining soil fertility, conserving moisture, and maintaining adequate cover to prevent soil blowing are concerns under dryland conditions. Controlling soil blowing, maintaining soil fertility, and managing irrigation water are the major concerns under irrigation.

Farms in areas of this association on the average are 1,000 acres in size. Farm produce is marketed mainly within the county or in adjacent counties.

Deep to shallow, silty and loamy soils on uplands

The soils in this group are deep to shallow, nearly level to strongly sloping, and well drained. Most of the nearly level to gently sloping soils are used for crops and are irrigated. The strongly sloping soils and small areas of the less sloping soils are used as rangeland. Soil blowing and water erosion are the main hazards. Conserving water for plant use, controlling soil blowing and water erosion, and maintaining fertility are the main concerns in management.

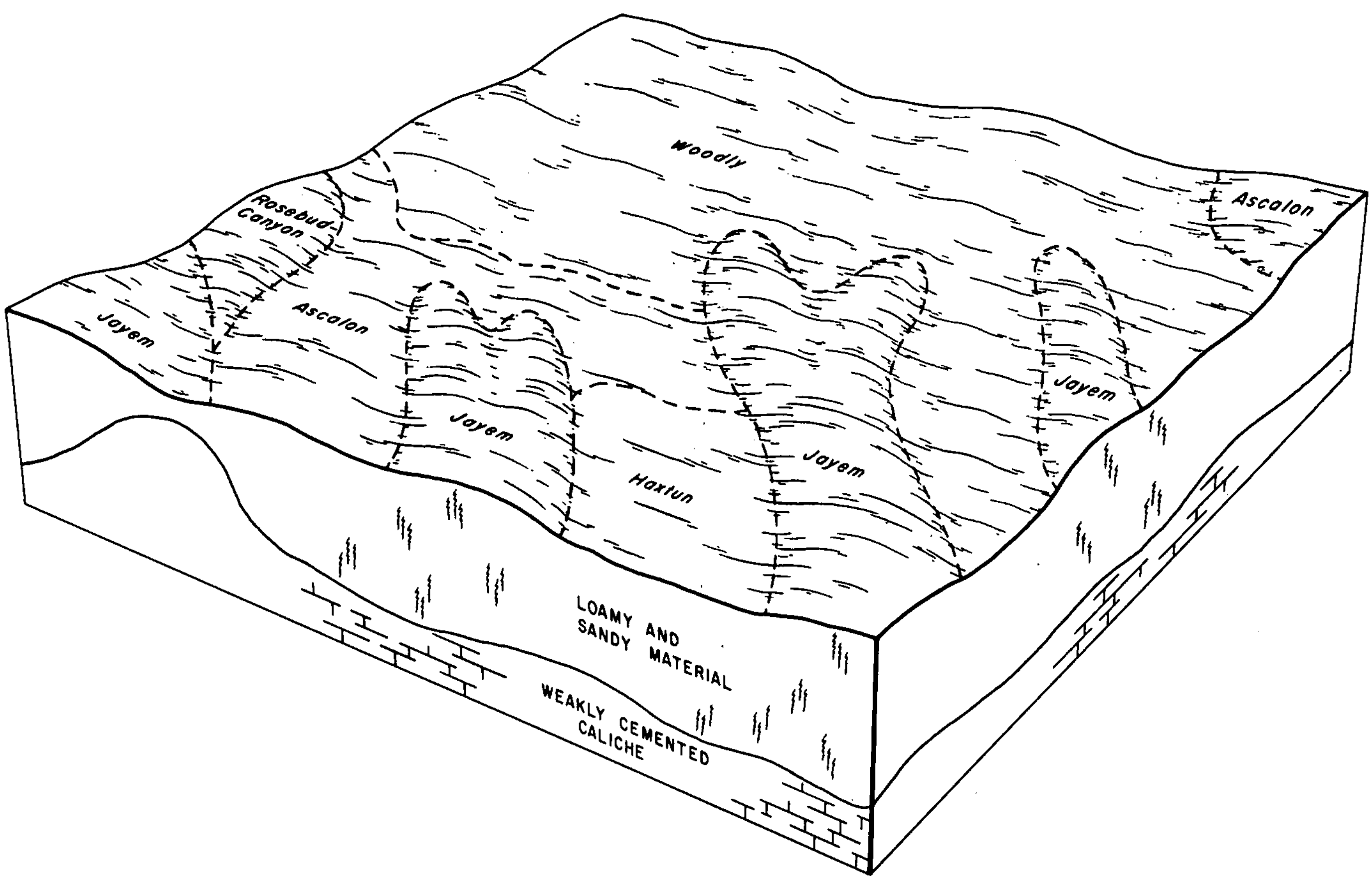

Figure 3.—Typical landscape pattern of the soils and underlying material in the Woodly-Jayem-Ascalon association.

3. Rosebud-Canyon association

Moderately deep and shallow, nearly level to strongly sloping, well drained, loamy soils that formed in residuum of weakly cemented caliche

This association consists of upland ridges and side slopes (fig. 4). Slopes range from 0 to 11 percent.

This association takes up about 85,167 acres, or about 15 percent of the county. It is about 50 percent Rosebud soils, 16 percent Canyon soils, and 34 percent soils of minor extent.

Rosebud soils are moderately deep and are on side slopes. Typically, the surface layer is grayish brown, very friable loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is brown, firm clay loam, and the lower part is light brownish gray, friable sandy clay loam. The underlying material is pale brown loam to a depth of 34 inches. Below that, white weakly cemented caliche extends to a depth of more than 60 inches.

Canyon soils are shallow and are on ridgetops. Typically, the surface layer is grayish brown, very friable loam about 4 inches thick. The next layer is light brownish gray, very friable loam about 6 inches thick. The underlying material is light gray loam to a depth of 17 inches. Below that, white weakly cemented caliche extends to a depth of more than 60 inches.

The minor soils in this association are mainly Alliance, Altvan, Ascalon, Goshen, and Kuma soils. Alliance soils are nearly level and deep. Altvan soils, on plains and side slopes, are nearly level and very gently sloping and are underlain by coarse sand. Ascalon soils are nearly level to gently sloping and are deep. They are on ridges above Rosebud and Canyon soils. Goshen and Kuma soils are nearly level and deep. They are adjacent to drainageways.

Farms in areas of this association are diversified. They are mainly combination cash crop-livestock enterprises. The soils are mainly under cultivation, and a major part of the acreage is irrigated. Corn, sugar beets, pinto

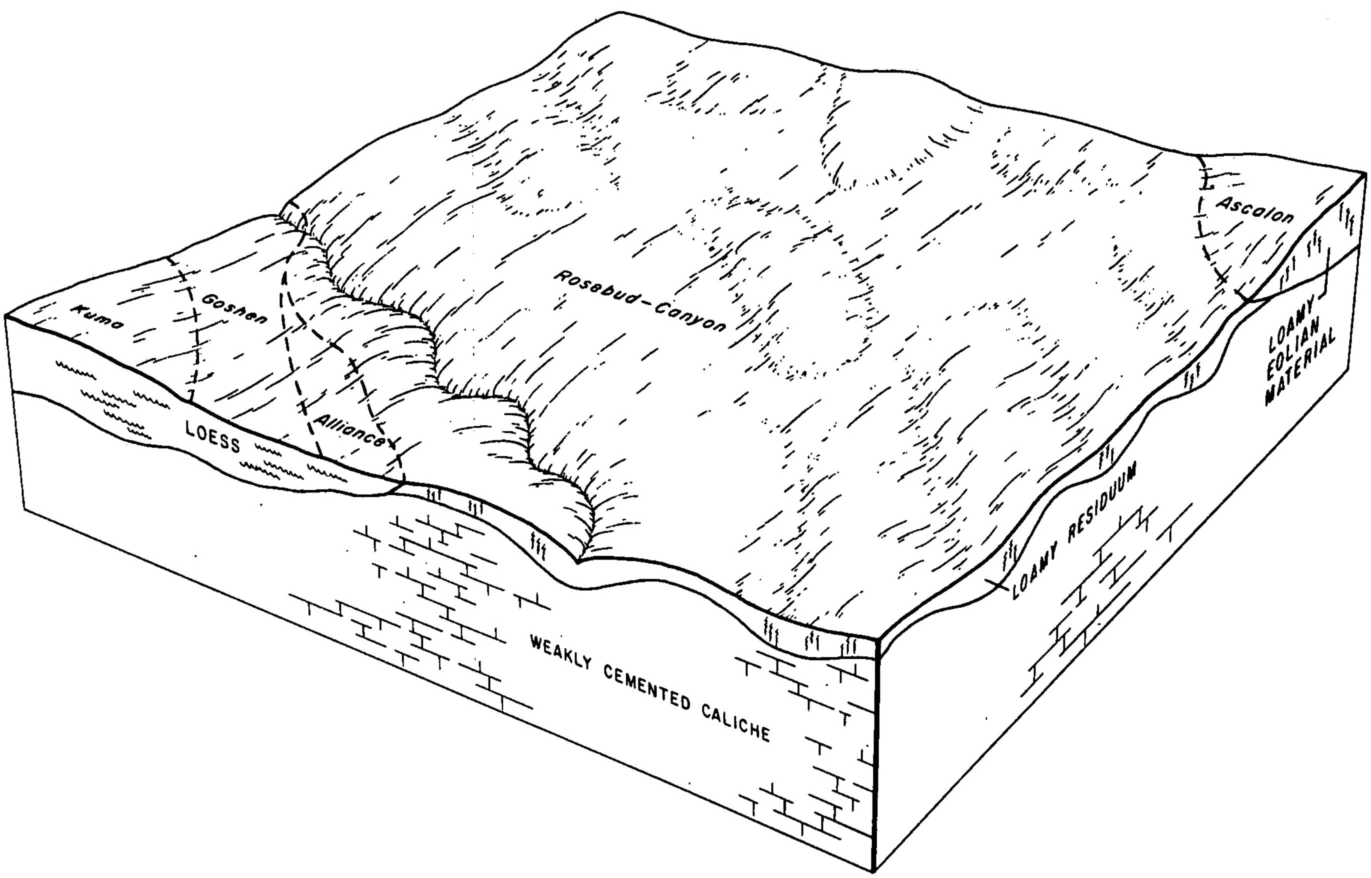

Figure 4.—Typical landscape pattern of the soils and underlying material in the Rosebud-Canyon association.

beans, and alfalfa are the main irrigated crops. Wheat is the main dryland crop. The rest of the acreage is in native grasses and is used as rangeland. Some livestock is fattened for market.

Soil blowing, water erosion, and drought are hazards. Limitations are a low moisture supply and a shallow to moderately deep root zone. Maintaining soil fertility, maintaining a plant cover, applying irrigation water, and conserving soil moisture are concerns in management.

Farms on the average are 1,000 acres in size. Farm produce is marketed within the county or in adjacent counties.

4. Alliance-Mace-Kuma association

Deep and moderately deep, nearly level and very gently sloping, well drained, silty soils that formed in loess and residuum from weakly cemented caliche

This association consists of smooth areas on uplands. Slopes range from 0 to 3 percent.

This association takes up about 50,023 acres or about 9 percent of the county. It is about 36 percent Alliance soils, 28 percent Mace soils, 23 percent Kuma soils, and 13 percent soils of minor extent.

Alliance soils are nearly level. Typically, the surface layer is grayish brown, very friable silt loam about 9 inches thick. The subsoil is about 15 inches thick. The upper part is grayish brown, friable silty clay loam. The lower part is pale brown, very friable silt loam. The underlying material is very pale brown very fine sandy loam to a depth of 50 inches. Below that, white weakly cemented caliche extends to a depth of more than 60 inches.

Mace soils are nearly level and very gently sloping. Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 18 inches thick. The upper part is grayish brown, friable clay loam, the middle part is dark grayish brown, friable silty clay loam, and the lower part is light brownish gray, friable silt loam. The underlying material is light gray silt loam to a depth of 30 inches. Below that, white weakly cemented caliche extends to a depth of more than 60 inches.

Kuma soils are nearly level. They are on broad flats. Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 37 inches thick. The upper part is grayish brown, very friable silt loam. The middle part consists of grayish brown, friable silty clay loam and a dark grayish brown, friable silty clay loam buried soil. The lower part is light brownish gray, very friable silt loam. The upper part of the underlying material is pale brown silt loam, and the lower part is very pale brown loam to a depth of more than 60 inches.

The minor soils in this association are mainly Altvan, Ascalon, Goshen, Rosebud, and Scott soils. Altvan soils are nearly level to gently undulating; they are on plains and side slopes and are underlain by coarse sand. Ascalon soils are nearly level to gently sloping. They are on ridges and side slopes and have more sand in the subsoil than the major soils. Goshen soils are nearly level. They are adjacent to drainageways. Rosebud soils are moderately deep and are nearly level to gently sloping. They are on side slopes along drainageways and have more sand in the subsoil than the major soils. Scott soils are poorly drained and are in upland basins.

Farms in areas of this association are cash crop enterprises. Most of the acreage is irrigated by water from high-producing deep wells. Either center-pivot sprinklers or gravity systems are used. Irrigated crops are mainly corn, sugar beets, pinto beans, and alfalfa. A minor part of the acreage is dry-farmed. Winter wheat is the main dryland crop. Some livestock is fattened for market.

Soil blowing is a hazard on both irrigated and dry-farmed cropland if the soil is without vegetative cover. Inadequate rainfall is a limitation for dryfarming. Maintaining soil fertility, protection against soil blowing, and proper water management are concerns under irrigation. Conserving soil moisture, maintaining adequate cover to prevent soil blowing, and maintaining soil fertility are concerns under dryland management.

Farms in areas of this association on the average are 1,000 acres in size. Farm produce is marketed within the county or in adjacent counties.

5. Kuma association

Deep, nearly level to gently sloping, well drained, silty soils that formed in loess

This association consists mainly of long, smooth areas on uplands (fig. 5). It also includes upland drainageways. Slopes range from 0 to 6 percent.

This association takes up about 37,500 acres, or about 6 percent of the county. It is about 93 percent Kuma soils and 7 percent soils of minor extent.

Kuma soils have a surface layer of grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 37 inches thick. The upper part is grayish brown, very friable silt loam, and the middle part is grayish brown, friable silty clay loam and dark grayish brown, friable silty clay loam. The lower part of the subsoil is light brownish gray, very friable silt loam. The upper part of the underlying material is pale brown silt loam, and the lower part is very pale brown very fine sandy loam to a depth of more than 60 inches.

The minor soils in this association are mainly Goshen, Keith, Scott, and Ulysses soils. Goshen soils are nearly level and are in broad drainageways below Kuma soils. They do not have a dark grayish brown buried layer like that of Kuma soils. Keith soils are very gently sloping and gently sloping and are on ridges and side slopes above Kuma soils; the dark color of the surface layer extends to a depth of less than 20 inches. Scott soils are poorly drained and are in upland depressions.

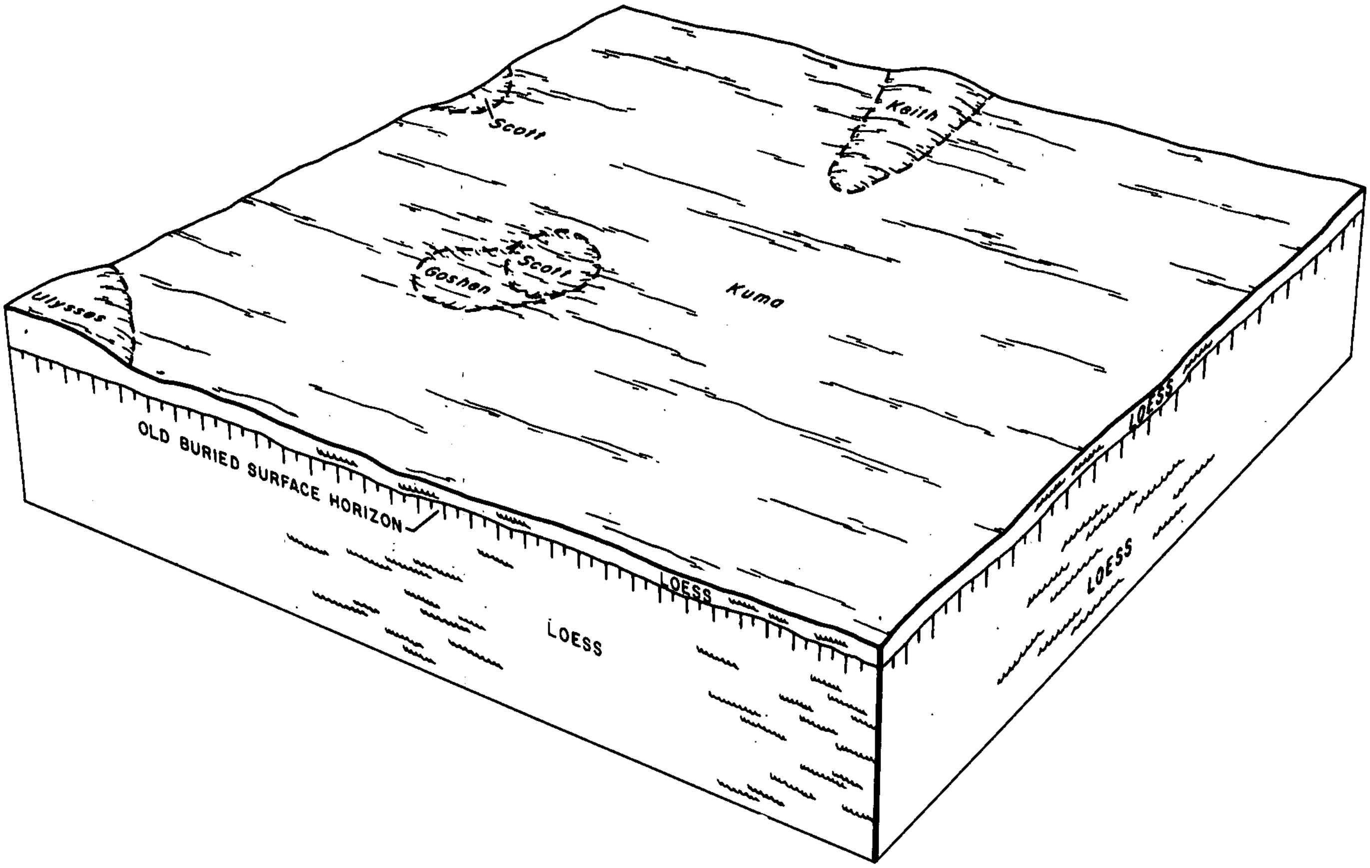

Figure 5.—Typical landscape pattern of the soils and underlying material in the Kuma association.

Ulysses soils are gently sloping and strongly sloping and are on side slopes. They have less clay in the subsoil than Kuma soils.

Farms in areas of this association are diversified. They are mainly combination cash grain-livestock enterprises. Most of the acreage is dry-farmed, but part is irrigated. The potential for irrigation is poor because sufficient water is not available in some areas and well yields are low. Corn and wheat are the main dryland crops. Corn and alfalfa are the main irrigated crops. Some livestock is fattened for market.

Farms in areas of this association on the average are 1,200 acres in size. Farm produce is marketed within the county or in adjacent counties.

Deep, silty soils on uplands

The soils in this group are deep, strongly sloping to very steep, and well drained and somewhat excessively drained. Most of the acreage is rangeland and is used for grazing. A small part of the association is cultivated. Soil blowing and water erosion are hazards if the grasses are overgrazed. Keeping the range in good to excellent condition is important in management.

6. Colby association

Deep, strongly sloping to very steep, well drained and somewhat excessively drained, silty soils that formed in loess

This association consists of uneven side slopes of deeply entrenched upland canyons (fig. 6). It includes some narrow bottom lands along natural drainageways at the bottom of the canyons. Slopes range from 6 to 60 percent.

This association takes up about 50,000 acres, or about 9 percent of the county. It is about 95 percent Colby soils and 5 percent soils of minor extent.

Colby soils are strongly sloping to very steep and are on side slopes. Typically, the surface layer is grayish

brown, very friable silt loam about 4 inches thick. The layer below that is light brownish gray, very friable silt loam about 6 inches thick. The upper part of the underlying material is pale brown silt loam, and the lower part is very pale brown silt loam to a depth of more than 60 inches.

The minor soils in this association are mainly Canyon, Otero, and Ulysses soils. Canyon and Otero soils are on very steep side slopes of canyons below areas of Colby soils. Canyon soils are shallow over weakly cemented caliche. Otero soils have more sand throughout than Colby soils. Ulysses soils are gently sloping and strongly sloping and are on ridges and side slopes above Colby soils. Unlike Colby soils, Ulysses soils have a dark surface layer and subsoil.

Farms in areas of this association are mainly livestock enterprises. The soils are in native grasses and are used as rangeland.

Water erosion is a severe hazard if the rangeland is overgrazed. Proper grazing use, timely deferment of grazing, and a planned grazing system are concerns in management.

Farms in areas of this association on the average are 2,000 acres in size. Water for livestock is supplied from wells pumped by windmills or electric motors. In some places, small dams collect runoff that provides water for livestock. Livestock is marketed locally or shipped to a distant market.

Deep and shallow, loamy soils on uplands

The soils in this group are deep and shallow, strongly sloping to very steep, and well drained. They are used as rangeland. Water erosion is a hazard if the grasses are overgrazed. Keeping the range in good to excellent condition is important in management.

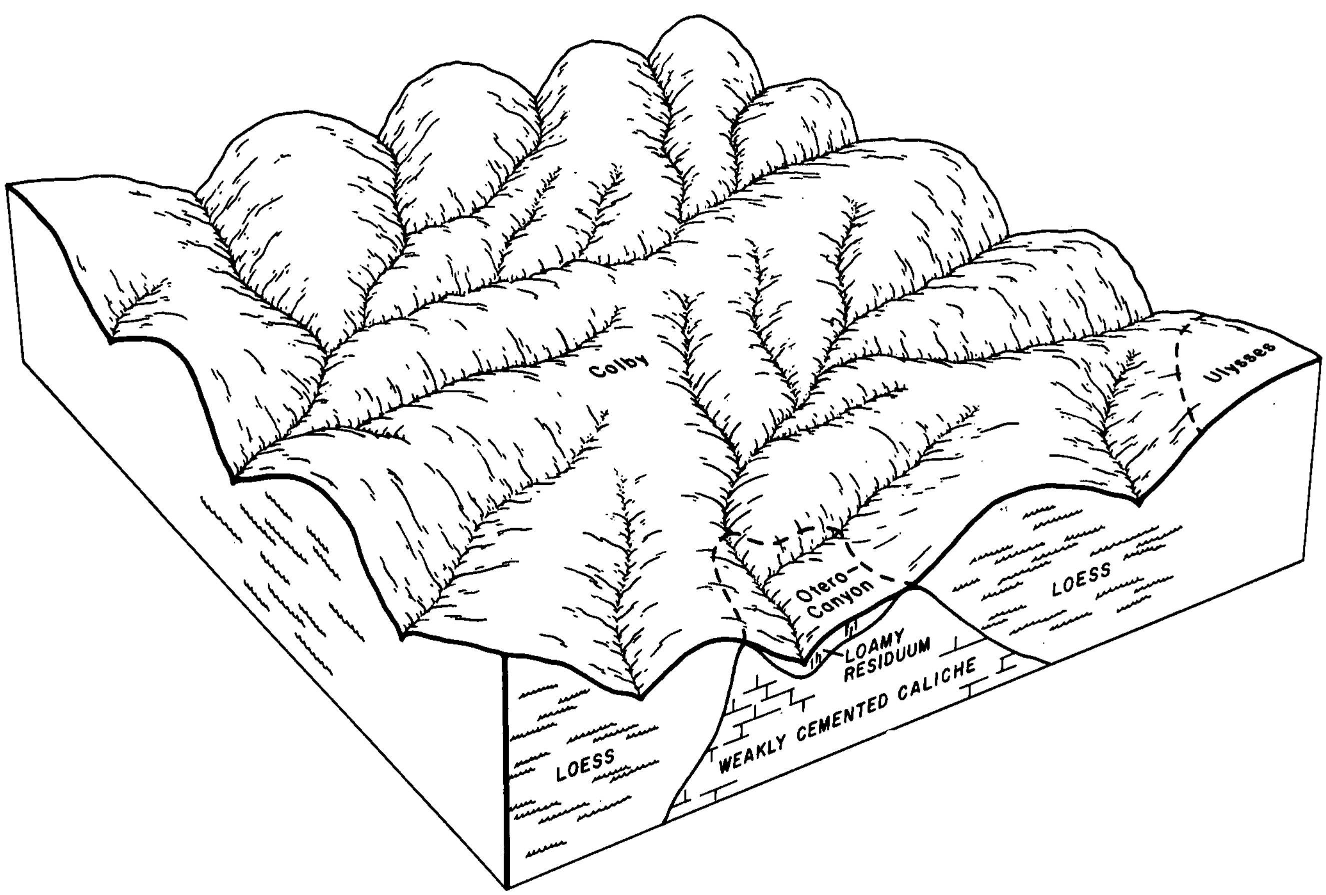

Figure 6.—Typical landscape pattern of the soils and underlying material in the Colby association.

7. Otero-Canyon association

Deep and shallow, strongly sloping to very steep, well drained, loamy soils that formed in loamy material and residuum of weakly cemented caliche

This association consists of side slopes and ridgetops of canyons and bluffs on uplands. Slopes range from 6 to 60 percent.

This association takes up about 23,040 acres, or about 4 percent of the county. It is about 52 percent Otero soils, 22 percent Canyon soils, and 26 percent soils of minor extent.

Otero soils are deep and are strongly sloping to very steep. They are on the lower side slopes below Canyon soils. Typically, the surface layer is grayish brown, very friable loam about 5 inches thick. The layer below that is light brownish gray, very friable very fine sandy loam about 7 inches thick. The underlying material is very pale brown very fine sandy loam to a depth of more than 60 inches.

Canyon soils are shallow and are strongly sloping to very steep. They are on ridgetops and upper side slopes of canyons. Typically, the surface layer is grayish brown, very friable loam about 4 inches thick. The layer below that is light brownish gray, very friable loam about 6 inches thick. The underlying material is light gray loam to a depth of 17 inches. Below that, white weakly cemented caliche extends to a depth of more than 60 inches.

The minor soils in this association are mainly Colby soils. Also, areas of alluvial material and rock outcrops are a minor part of this association. Colby soils are deep and are on side slopes above areas of Canyon and Otero soils. They have more silt throughout. The alluvial material is at the bottom of the canyons along the drainageways. The rock outcrops are ledges in areas of Canyon soils.

Farms are mainly livestock enterprises. The soils are in native grasses and are used as rangeland. Water erosion is a hazard if the range is overgrazed. Proper grazing use, timely deferment of grazing, and a planned grazing system are concerns in management.

Farms on the average are 2,000 acres in size. Water for livestock is mainly pumped by windmills from deep wells. In some places, small ponds supply water for livestock. Livestock is marketed within the county or in adjacent counties.

Deep, silty and loamy soils on bottom lands and stream terraces

The soils in this group are deep, nearly level to very gently sloping, and very poorly drained, somewhat poorly drained, moderately well drained, and well drained. The very poorly drained and somewhat poorly drained soils are used as rangeland and are grazed or hayed. The moderately well drained and well drained soils are used for crops and are irrigated or dry-farmed. Keeping the range in good to excellent condition is an important concern in rangeland management. Maintaining soil fertility is an important concern in cropland management.

8. Gannett-Wann-Gibbon association

Deep, nearly level, very poorly drained and somewhat poorly drained, silty and loamy soils that formed in alluvium

This association consists of nearly level areas and depressions on bottom lands. Slopes range from 0 to 2 percent.

This association takes up about 10,232 acres, or about 2 percent of the county. It is about 28 percent Gannett soils, 20 percent Wann soils, 18 percent Gibbon soils, and 34 percent soils of minor extent.

Gannett soils are in depressions along major streams. They are very poorly drained. Typically, about 11 inches of overwash material is on the surface. This material is light gray, very friable silt loam in the upper part and gray, mottled, friable silt loam in the lower part. The original surface layer, from a depth of 11 to 30 inches, is dark gray, friable silt loam. The subsurface layer is dark gray, friable very fine sandy loam about 20 inches thick. The underlying material is stratified, dark gray, gray, and light gray very fine sandy loam to a depth of more than 60 inches.

Wann soils are nearly level and are adjacent to major streams. They are somewhat poorly drained. Typically, the surface layer is grayish brown, very friable fine sandy loam about 12 inches thick. The underlying material is light gray fine sandy loam in the upper part and very pale brown very fine sandy loam in the lower part to a depth of more than 60 inches.

Gibbon soils are nearly level and are near major streams. They are somewhat poorly drained. Typically, the surface layer is dark grayish brown, friable silt loam about 9 inches thick. The layer below that is light brownish gray, very friable silt loam about 6 inches thick. The underlying material is stratified. It is light gray very fine sandy loam, grayish brown silt loam, and white very fine sandy loam to a depth of more than 60 inches.

The minor soils in this association are mainly Bridget, Bushman, Caruso, Creighton, and McCook soils and Fluvaquents. Bridget soils are well drained and are on stream terraces and foot slopes. Caruso soils are somewhat poorly drained and are on bottom lands near streams. Creighton soils are well drained and are on stream terraces. McCook soils are well drained and moderately well drained and are on bottom lands and low stream terraces. Fluvaquents are very poorly drained and are in low areas on bottom lands.

The soils are mainly in native grasses and are used as rangeland or mowed for hay. In a few areas the soils are farmed. Corn and alfalfa for feed are the main crops.

Occasional flooding is a hazard. Proper grazing use, deferment of grazing or haying when the soil is wet, and a planned grazing system are concerns in management. Livestock is marketed locally or in adjacent counties.

9. Bridget-McCook association

Deep, nearly level to very gently sloping, well drained and moderately well drained, silty soils that formed in colluvial and alluvial deposits

This association consists of bottom lands and stream terraces. Slopes range from 0 to 3 percent.

This association takes up about 3,328 acres, or about 1 percent of the county. It is about 44 percent Bridget soils, 38 percent McCook soils, and 18 percent soils of minor extent.

Bridget soils are nearly level and very gently sloping. They are on stream terraces and foot slopes. They are well drained. Typically, the surface layer is grayish brown, friable silt loam about 12 inches thick. The layer below that is pale brown, friable silt loam about 9 inches thick. The underlying material is very pale brown very fine sandy loam to a depth of more than 60 inches.

McCook soils are nearly level. They are on bottom lands and low stream terraces. They are well drained and moderately well drained. Typically, the surface layer is grayish brown, very friable silt loam about 10 inches thick. The layer below that is light brownish gray, very friable silt loam about 8 inches thick. The underlying material is pale brown, finely stratified silt loam in the upper part, light brownish gray silt loam in the middle part, and light brownish gray very fine sandy loam to a depth of more than 60 inches.

The minor soils in this association are Wann soils. They are somewhat poorly drained and are on bottom lands near streams.

Farms are mainly cash grain-livestock enterprises. Livestock is fattened in feedlots for market. The soils are mainly farmed, and a considerable acreage is irrigated. Corn, alfalfa, and wheat are the main crops. Water yields from wells in areas of this association generally are high.

Rare to occasional flooding is a hazard on the McCook soils. Soil blowing is a hazard on both irrigated and dry-farmed cropland if the soil is bare of plant cover. Insufficient rainfall is a limitation for dryfarming. Maintaining soil fertility is a concern in management. Farm produce is marketed within the county or in adjacent counties.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Kuma silt loam, 0 to 1 percent slopes, is one of several phases in the Kuma series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Rosebud-Canyon loams, 0 to 3 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

As a result of improvements in the classification of soils, particularly modifications or refinements in soil series concepts, and of differences in the range in slope that is used in different survey areas, some of the boundaries and soil series names on the detailed soil maps of Chase County do not match those on the soil maps of adjacent counties.

soil descriptions

Ac—Alliance silt loam, 0 to 1 percent slopes. This is a deep, nearly level, well drained soil on loess-covered uplands. The areas of this soil range from 15 to 1,800 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 9 inches thick. The subsoil is about 15 inches thick. The upper part is grayish brown, friable silty clay loam, and the lower part is pale brown, very friable silt loam. The underlying material is very pale brown very fine sandy loam to a depth of 50 inches. Below that, white, weakly cemented caliche extends to a depth of more than 60 inches. In a few areas, the surface layer is loam, and in a few areas, the surface layer is less than 9 inches thick because of land leveling. In a few areas, the subsoil contains a dark buried soil.

Included with this soil in mapping are small areas of Kuma, Mace, and Rosebud soils. Kuma soils are dark to a depth of more than 20 inches, have a buried soil in the subsoil, and have weakly cemented caliche at a depth of more than 60 inches. Kuma soils are in slightly lower positions than the Alliance soil. Mace soils have weakly cemented caliche at a depth of 20 to 40 inches and are on landscapes similar to those of the Alliance soil. Rosebud soils are slightly higher on the landscape than the Alliance soil and have a coarser subsoil. In Rosebud soils, the depth to weakly cemented caliche is 20 to 40 inches. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderately slow, and the available water capacity is high. Runoff is slow, and the water

intake rate for irrigation is moderately low. The content of organic matter is moderate.

Most of the acreage of this soil is farmed. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for hay or pasture. The main limitation is a shortage of rainfall during the growing season. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help conserve moisture and prevent serious soil blowing. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, grain sorghum, sugar beets, pinto beans, and alfalfa. Introduced grasses can be grown for hay or pasture. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the soil surface help prevent soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility and also increase infiltration of water.

This soil is suited to adapted trees and shrubs in farmstead, field, and livestock windbreaks. The main hazards and limitations are drought, competition for moisture from weeds and grasses, and soil blowing. Irrigation can supply moisture in periods of low rainfall. Undesirable grasses and weeds can be controlled by cultivating between the tree rows with conventional equipment. Herbicides help control weeds in the tree row. Weeds that are in the row or close to small trees can be eliminated by hand hoeing or rototilling. A cover crop between the rows helps reduce soil blowing.

This soil generally is suited to use as sites for houses and small commercial buildings. Mounding a septic tank absorption field on several feet of suitable fill material increases the filtering capacity of the field. The moderately slow permeability is a limitation for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Sewage lagoons can be constructed on this soil if they are lined or sealed to prevent seepage. The sides or walls of shallow excavations can be shored to prevent sloughing or caving. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIc-1, dryland, and I-4, irrigated, to the Silty range site, and to windbreak suitability group 3.

Af—Altvan loam, 0 to 1 percent slopes. This is a nearly level, well drained soil on uplands. It is moderately deep over sand and gravelly sand. The areas range from 20 to 480 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 7 inches thick. The subsoil is about 19 inches thick. The upper part is grayish brown, firm clay loam; the middle part is pale brown, firm clay loam; and the lower part is pale brown, friable loam. The underlying material is pink, calcareous sand to a depth of more than 60 inches. In a few small areas, the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Ascalon and Rosebud soils. Ascalon soils are deep and are in higher positions than the Altvan soil. Rosebud soils are underlain by weakly cemented caliche at a depth of 20 to 40 inches and are higher on the landscape than the Altvan soil. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderate in the surface layer and subsoil and very rapid in the underlying sand and gravelly sand. The available water capacity is low. The content of organic matter is moderately low. Runoff is slow. The water intake rate is moderate.

Almost all of the acreage of this soil is farmed. Under dryland management, this soil is suited to wheat and introduced grasses for hay or pasture. Shortage of rainfall during the growing season is a limitation. The main hazard is soil blowing if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase the infiltration of water. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses for hay or pasture. The low available water capacity is a limitation. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Applying water only when and as needed increases the efficiency of an irrigation system. Good crop residue management and the use of cover crops protect against soil blowing. Returning crop residue to the soil helps maintain or improve the content of organic matter.

This soil is suited to adapted trees and shrubs in farmstead, livestock, and field windbreaks. The main limitations and hazards are drought, competition from weeds and undesirable grasses, the low available water capacity, and soil blowing. Irrigation can supply moisture in periods of insufficient rainfall. Cultivation between the rows with conventional equipment can control undesirable grasses and weeds. Herbicides or hoeing by hand can control weeds in the row. A cover crop helps prevent soil blowing.

This soil generally is suited to use as sites for dwellings and small commercial buildings. Seepage from

septic tank absorption fields can contaminate the ground water. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIc-1, dryland, and IIs-7, irrigated, to the Silty range site, and to windbreak suitability group 6G.

AfB—Altvan loam, 1 to 3 percent slopes. This is a very gently sloping, well drained soil on ridges on uplands. It is moderately deep over sand and gravelly sand. The areas range from 15 to 320 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 5 inches thick. The subsoil is about 19 inches thick. The upper part is grayish brown, friable loam; the middle part is light brownish gray, firm clay loam; and the lower part is very pale brown, friable loam. The underlying material is pink, calcareous sandy loam in the upper part and pink, calcareous gravelly coarse sand in the lower part to a depth of more than 60 inches. In a few small areas, the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Ascalon and Rosebud soils. Ascalon soils are deep and are on about the same kind of landscape as the Altvan soil. Rosebud soils are underlain by weakly cemented caliche at a depth of 20 to 40 inches and are in higher positions on the landscape than the Altvan soil. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderate in the surface layer and subsoil and very rapid in the underlying sand and gravelly sand. The available water capacity is low. The content of organic matter is moderately low. Runoff is medium, and the water intake rate is moderate.

Most of the acreage of this soil is farmed. Under dryland management, this soil is suited to wheat and introduced grasses for hay or pasture. The main hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. A limitation is a shortage of rainfall during the growing season. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help to maintain or improve the content of organic matter, fertility, and soil tilth and also to increase infiltration of water. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses. Water erosion and soil blowing are hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to adapted trees and shrubs in farmstead, livestock, and field windbreaks. The major limitations and hazards are drought, slope and excessive runoff, competition from weeds and undesirable grasses, the low available water capacity, and soil blowing. Irrigation can supply moisture in periods of insufficient rainfall. Planting trees on the contour allows normal cultivation between the rows to store moisture and control weeds. Herbicides or hand hoeing can control weeds in the row. A cover crop can reduce soil blowing.

This soil generally is suited to use as sites for dwellings and small commercial buildings. Seepage from septic tank absorption fields can contaminate the ground water. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-7, irrigated, to the Silty range site, and to windbreak suitability group 6G.

AfC—Altvan loam, 3 to 6 percent slopes. This is a gently sloping, well drained soil on side slopes and ridges on uplands. It is moderately deep over sand and gravelly sand. The areas range from 15 to 80 acres in size.

Typically, the surface layer is brown, very friable loam about 7 inches thick. The subsoil is about 12 inches thick. The upper part is grayish brown, friable sandy clay loam, and the lower part is dark grayish brown, firm clay loam. The underlying material is pale brown, calcareous silt loam in the upper part and very pale brown, calcareous sand in the lower part to a depth of more than 60 inches. In a few small areas, the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Ascalon, Canyon, and Rosebud soils. Ascalon soils are deep and are on landscapes similar to those of the Altvan soil. Canyon soils are shallow over weakly cemented caliche and are in higher positions on the landscape than the Altvan soil. Rosebud soils are underlain by weakly cemented caliche at a depth of 20 to 40 inches and are in higher positions on the landscape. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderate in the surface layer and subsoil and very rapid in the underlying sand. The available water capacity is low. The content of organic matter is moderately low. Runoff is medium, and the water intake rate is moderate.

Most of the acreage of this soil is farmed In a few small areas the soil is in native grasses, which are used for grazing or mowed for hay. Under dryland management, this soil is suited to wheat and introduced grasses for hay or pasture. Soil blowing and water erosion are hazards if the surface is not adequately protected by crops or crop residue. Shortage of rainfall during the growing season is a limitation. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion and conserve soil moisture. Terraces can be used to control water where slopes are long. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses. Soil blowing and water erosion are hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion as well as conserve soil moisture. Efficient management of irrigation water is a concern. Feedlot manure, green manure crops, and crop residue help to improve infiltration of water.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can result in severe soil losses from water erosion. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to adapted trees and shrubs in farmstead, livestock, and field windbreaks. The major hazards are drought and soil blowing, and the major limitation is an inadequate moisture supply. Irrigation can supply moisture in periods of insufficient rainfall. Planting trees on the contour allows normal cultivation between the tree rows to help store moisture and control weeds. Appropriate herbicides or hand hoeing can control weeds in the row. A cover crop can reduce soil blowing.

This soil generally is suited to use as building sites for houses and small commercial buildings. Seepage from septic tank absorption fields can contaminate the ground water. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IVe-1, dryland, and IVe-7, irrigated, to the Silty range site, and to windbreak suitability group 6G.

AsB—Ascalon fine sandy loam, 1 to 3 percent slopes. This is a deep, nearly level to very gently sloping, well drained soil on uplands. The areas of this soil range from 15 to 1,000 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 6 inches thick. The subsoil is about 22 inches thick. The upper part is grayish brown, very friable fine sandy loam; the middle part is brown, friable sandy clay loam; and the lower part is pale brown, very friable fine sandy loam. The underlying material is very pale brown very fine sandy loam to a depth of more than 60 inches. In some areas, the surface layer is loamy fine sand or loamy sand.

Included with this soil in mapping are small areas of Alliance, Creighton, Rosebud, and Woodly soils. Alliance soils are at a slightly lower elevation and have a finer textured subsoil than the Ascalon soil. Creighton soils are in lower positions on the landscape than the Ascalon soil and are coarser textured throughout. Rosebud soils are at a slightly higher elevation, and their depth to weakly cemented caliche is 20 to 40 inches. Woodly soils are on landscapes similar to those of the Ascalon soil. Woodly soils are dark colored to a depth of more than 20 inches. The included soils make up 13 to 15 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is medium, and the water intake rate for irrigation is moderate. The content of organic matter is moderate. The soil is easily tilled within a wide range of moisture content.

Most of the acreage of this soil is farmed. In a few areas the soil is in native grasses, which are used for grazing or mowed for hay. Under dryland management, this soil is suited to wheat and introduced grasses for hay or pasture. The major hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. Inadequate rainfall during the growing season is a limitation. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help to maintain or improve the content of organic matter, fertility, and tilth and also to increase infiltration of water. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, and alfalfa. Water erosion and soil blowing are hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve moisture. Efficient

management of irrigation water is a concern. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can result in severe losses from soil blowing. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in field, farmstead, and livestock windbreaks. The major hazards and limitations are water erosion, soil blowing, and competition for moisture from weeds and grasses. Seedlings generally survive and grow if competing plants are controlled. Good site preparation and timely cultivation between tree rows can eliminate weeds. Leaving the surface rough or planting a cover crop between tree rows helps control soil blowing and water erosion.

This soil generally is suited to use as building sites for dwellings and small commercial buildings. The moderate permeability is a limitation for septic tank absorption fields, but this limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIe-3, dryland, and IIe-5, irrigated, to the Sandy range site, and to windbreak suitability group 5.

AsC—Ascalon fine sandy loam, 3 to 6 percent slopes. This is a deep, gently sloping, well drained soil on uplands. The areas of this soil range from 10 to 320 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 6 inches thick. The subsoil is about 20 inches thick. The upper part is brown, friable sandy clay loam, and the lower part is light gray, very friable fine sandy loam. The underlying material, to a depth of 40 inches, is very pale brown, very friable fine sandy loam. Below that, very pale brown loamy fine sand extends to a depth of more than 60 inches. In a few small areas, the surface layer is sandy loam, loamy sand, or loam.

Included with this soil in mapping are small areas of Jayem and Rosebud soils on about the same kind of landscape as the Ascalon soil. Jayem soils are sandier throughout than the Ascalon soil, and Rosebud soils have weakly cemented caliche at a depth of 20 to 40 inches. The included soils make up 3 to 10 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is medium, and the water intake rate for irrigation is moderate. The content of organic matter is moderate. This soil is easily tilled within a wide range of moisture content.

Most of the acreage of this soil is farmed. In a few areas, the soil is in native grasses, which are grazed or mowed for hay. Under dryland management, this soil is suited to wheat and introduced grasses for hay or pasture. The major hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. Inadequate rainfall during the growing season is a limitation. Row crops grown on the contour help prevent serious water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and also conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and increase infiltration of water. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses for hay or pasture. Water erosion and soil blowing are hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and also conserve soil moisture. Proper water application rate helps prevent serious water erosion. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Severe losses from soil blowing and small blowouts can also result. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in field, livestock, and farmstead windbreaks. The main hazards are water erosion and soil blowing. Competition for moisture from weeds and grasses is a problem. Leaving the surface rough or planting a cover crop between tree rows helps control water erosion and soil blowing. Seedlings generally survive and grow if competing plants are controlled. Good site preparation and timely cultivation can eliminate weeds.

This soil generally is suited to use as a site for buildings. The moderate permeability is a limitation for

septic tank absorption fields, but this limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units III-3, dryland, and IIIe-5, irrigated, to the Sandy range site, and to windbreak suitability group 5.

BeB—Blanche very fine sandy loam, 0 to 3 percent slopes. This is a moderately deep, nearly level to very gently sloping, and well drained soil on uplands. The areas of this soil range from 15 to 300 acres in size.

Typically, the surface layer is dark grayish brown, very friable very fine sandy loam about 11 inches thick. The subsoil is about 23 inches thick. It is dark grayish brown, very friable fine sandy loam in the upper part, grayish brown, very friable fine sandy loam in the middle part, and light brownish gray, very friable, calcareous fine sandy loam in the lower part. Below that, white, calcareous weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is loam. Also, in a few small areas, the upper part of the subsoil is sandy clay loam.

Included with this soil in mapping are small areas of Canyon and Vetal soils. Canyon soils are shallow and are on ridges above the Blanche soil. Vetal soils do not have bedrock within a depth of 60 inches and are in a lower position on the landscape than the Blanche soil. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderately rapid. The available water capacity is moderate. Runoff is slow or medium, and the water intake rate for irrigation is very high. The content of organic matter is moderately low.

Most of the acreage of this soil is farmed. In a few areas the soil is in native grasses, which are grazed or mowed for hay. Under dryland management, this soil is poorly suited to wheat. Introduced grasses can be grown for hay or pasture. Inadequate rainfall during the growing season and a moderately deep root zone are the main limitations. Water erosion and soil blowing are the major hazards if the surface is not adequately protected by crops or crop residue. Terracing and discing, stubble mulching, chiseling, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and also conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, this soil is suited to corn, alfalfa, legumes, and introduced grasses for hay or pasture. The major hazards are soil blowing and water erosion if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion and also conserve soil moisture. Properly designed irrigation systems help control water erosion and increase the efficiency of irrigation. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Severe losses from soil blowing and small blowouts can also result. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in farmstead, livestock, and field windbreaks. The rate of survival and growth of trees that are adapted to this soil is moderate. The major hazards and limitations are loose surface soil, soil blowing and covering of seedlings by drifting sand in high winds, insufficient moisture, and competition from weeds and undesirable grasses. Maintaining strips of sod or a cover crop between tree rows helps prevent loose soil and soil blowing. Irrigation can supply water in dry periods. Appropriate herbicides near the trees and cultivation between the tree rows control weeds and undesirable grasses.

This soil generally is suited to use as sites for houses without basements and small commercial buildings and to local roads and streets. Building up or mounding a septic tank absorption field site with suitable fill material increases the filtering capacity of the field. Sewage lagoons can be constructed on this soil if they are lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving. The soft bedrock generally can be easily excavated for construction of houses with basements or for buildings that have deep foundations.

This soil is assigned to capability units IVe-5, dryland, and IVe-7, irrigated, to the Sandy range site, and to windbreak suitability group 6R.

Bg—Bridget silt loam, 0 to 1 percent slopes. This is a deep, nearly level, well drained soil on colluvial and alluvial foot slopes and stream terraces. The areas of this soil range from 15 to 240 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 12 inches thick. Below that, there is a

transition layer of light brownish gray, friable silt loam about 5 inches thick. The underlying material is very pale brown silt loam to a depth of more than 60 inches. In some areas, the soil material is grayish brown to a depth of more than 20 inches.

Included with this soil in mapping are small areas of McCook and Ulysses soils. McCook soils are on bottom lands below the Bridget soil and are stratified. Ulysses soils are finer textured and are above the Bridget soil on the landscape. The included soils make up less than 10 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is slow. The content of organic matter is moderate. The water intake rate for irrigation is moderate. The surface layer is easily tilled within a wide range of moisture content.

Most of the acreage of this soil is farmed, and most fields are irrigated if water is available. In a few areas, the soil is in native grasses, which are used for grazing or mowed for hay.

Under dryland management, this soil is suited to wheat and introduced grasses. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Inadequate rainfall during the growing season is a limitation. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and also conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase the infiltration of water. Summer fallow is used if wheat is grown.

Under gravity and sprinkler irrigation, this soil is suited to corn, alfalfa, sugar beets, pinto beans, and introduced grasses. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and also conserve soil moisture. Efficient management of irrigation water is a concern. Returning crop residue to the soil and applying fertilizer help to maintain or improve the fertility of the soil.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in all types of windbreaks and shelterbelts. The major hazards and limitations are a shortage of rainfall, competition for moisture from weeds and grasses, and soil blowing. Irrigation can supply moisture in periods of low rainfall. Cultivation between the rows of trees and shrubs with conventional equipment and the use of appropriate herbicides in the row help control weeds and undesirable grasses. A cover crop between the rows can reduce soil blowing.

This soil generally is suited to use as septic tank absorption fields and building sites for houses and small commercial buildings. Sewage lagoons need to be lined or sealed to prevent seepage. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIc-1, dryland, and I-6, irrigated, to the Silty range site, and to windbreak suitability group 3.

BgB—Bridget silt loam, 1 to 3 percent slopes. This is a deep, very gently sloping, well drained soil on colluvial and alluvial foot slopes and stream terraces. The areas of this soil range from 5 to 100 acres in size.

Typically, the surface layer is grayish brown, friable silt loam about 12 inches thick. A transition layer below the surface layer is pale brown, friable silt loam about 9 inches thick. The underlying material to a depth of more than 60 inches is very pale brown very fine sandy loam. In some areas, the soil is grayish brown to a depth of more than 20 inches.

Included with this soil in mapping are small areas of McCook and Ulysses soils. McCook soils are on bottom lands below the Bridget soil and are stratified. Ulysses soils are finer textured and are above the Bridget soil on the landscape. The included soils make up less than 10 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is slow. The content of organic matter is moderate. The water intake rate for irrigation is moderate. The surface layer is easily tilled within a wide range of moisture content.

Most of the acreage is farmed, but in a few areas the soil is in native grasses, which are grazed or mowed for hay. Most of the farmed acreage is irrigated if water is available.

Under dryland management, this soil is suited to wheat and introduced grasses. Soil blowing and water erosion are hazards if the surface is not adequately protected by crops and crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the soil surface help prevent soil blowing and water erosion and also conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase infiltration of water. Terraces help reduce soil loss from water erosion. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses. Soil blowing and water erosion are hazards if the surface is not

adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion and conserve soil moisture. Efficient management of irrigation water is a concern. Crop residue, green manure crops, fertilizer, and feedlot manure help to maintain or improve the fertility of the soil.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in all types of windbreaks and shelterbelts. Competition for moisture from grasses and weeds is the main concern in establishing seedlings. Weeds can be eliminated by good site preparation and by timely cultivation between tree rows. Herbicides can also be used to control weeds.

This soil generally is suited to use as septic tank absorption fields and as sites for houses and small commercial buildings. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIe-1, dryland, and IIe-6, irrigated, to the Silty range site, and to windbreak suitability group 3.

BuC—Bushman very fine sandy loam, 1 to 4 percent slopes. This is a deep, very gently sloping and gently sloping, and well drained soil on foot slopes and stream terraces. The areas range in size from 15 to 400 acres.

Typically, the surface layer is dark grayish brown, very friable very fine sandy loam about 13 inches thick. Below that, there is a transition layer of light brownish gray, very friable very fine sandy loam about 11 inches thick. The underlying material is pale brown very fine sandy loam to a depth of more than 60 inches. In a few small areas, the surface layer is fine sandy loam or loam.

Included with this soil in mapping are small areas of Caruso soils. Caruso soils are finer textured and are somewhat poorly drained, and they are in lower positions than the Bushman soil. They make up 2 to 6 percent of the map unit.

Permeability is moderately rapid, and the available water capacity is high. The water intake rate is moderate, and runoff is medium. The content of organic matter is moderately low. The surface layer is easily tilled within a wide range of moisture content. This soil releases moisture readily to plants.

Most of the acreage of this soil is in native grasses, which are grazed or mowed for hay, but in a few areas, the soil is farmed. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for hay or pasture. Soil blowing and water erosion are major hazards if the surface is not adequately protected by crops or crop residue. Inadequate rainfall during the growing season is a limitation. If the slopes are long and smooth enough, this soil can be terraced and farmed on the contour to prevent serious water erosion. Stubble mulching, discing, chiseling, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help to maintain or improve the content of organic matter, fertility, and tilth and also to increase infiltration of water. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, grain sorghum, alfalfa, and introduced grasses. This soil is susceptible to water erosion and soil blowing if it is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve soil moisture. Timely water application and a correctly designed sprinkler irrigation system increase the efficiency of irrigation. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can result in severe soil losses from water erosion and soil blowing. Proper grazing use, timely deferment of grazing, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in farmstead, field, and livestock windbreaks. The major hazards and limitations are water erosion and excessive runoff, drought, competition for moisture from weeds and grasses, and soil blowing. Planting trees on the contour helps prevent erosion. Terraces are also helpful. Irrigation can supply moisture during periods of low rainfall. Cultivation in the row and herbicides can help control undesirable grasses and weeds. Strips of sod or a cover crop between the rows can reduce soil blowing.

This soil generally is suited to use as septic tank absorption fields, sites for houses and small commercial buildings, and roads and streets. Sewage lagoons need to be lined or sealed to prevent seepage.

This soil is assigned to capabiity units IIIe-1, dryland, and IIe-6, irrigated, to the Limy Upland range site, and to windbreak suitability group 8.

Cb—Caruso loam, 0 to 2 percent slopes. This is a deep, nearly level, and somewhat poorly drained soil on bottom lands. This soil is occasionally flooded. The areas range from 10 to 300 acres in size.

Typically, the surface layer is grayish brown, friable, calcareous loam about 12 inches thick. The underlying material is light brownish gray, calcareous loam in the upper part, stratified light gray and dark grayish brown, calcareous loam in the middle part, and light gray, mottled, calcareous loam in the lower part, which extends to a depth of more than 60 inches. In some areas, the surface layer is sandy loam or silt loam.

Included with this soil in mapping are small areas of Gibbon and Wann soils on similar landscapes. Gibbon soils have more silt than the Caruso soil, and Wann soils have more sand. The included soils make up 5 to 12 percent of the map unit.

Permeability is moderate. The available water capacity is high. Runoff is slow. The content of organic matter is moderate. The water intake rate is moderate. Reaction is mildly alkaline to strongly alkaline throughout. The seasonal high water table ranges from a depth of about 2 feet in wet years to a depth of 3 feet in dry years.

Most of the acreage is in native grasses, which are grazed or mowed for hay. In a few areas, the soil is farmed.

Under dryland management, this soil is suited to wheat and alfalfa. Occasional flooding is a hazard. Dams, dikes, or diversions can protect the fields from occasional flooding. Wetness caused by the water table is a major limitation. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, alfalfa, pinto beans, and sugar beets. The main hazard is occasional flooding. The major limitation is wetness caused by the water table. Dikes can prevent occasional flooding. Tile drainage can lower the water table and protect crops from damage caused by wetness. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter.

This soil is suited to use as rangeland for either grazing or haying. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. In addition, overgrazing when the soil is wet can cause surface compaction and the formation of small mounds, making grazing or hay harvesting difficult. Proper grazing use and timely deferment of grazing or haying, along with restricted use in very wet periods, help maintain the native plants in good condition.

This soil is poorly suited to trees and shrubs in windbreaks. Adapted species that tolerate occasional wetness generally survive and grow well. The herbaceous vegetation that grows on this soil is abundant and persistent. It can be controlled by cultivating between the rows with conventional equipment. Areas close to the trees can be hoed by hand. Establishing seedlings can be a problem in wet years. The soil can be tilled and the seedlings planted after the soil has dried.

This soil generally is not suited to septic tank absorption fields because of flooding. A substitute site is needed. Sewage lagoons need to be diked for protection against flooding. They should be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table. Shallow excavations also need to be diked. This soil is not suited to use as building sites because of flooding. Constructing roads on suitable, well compacted fill material above flood level and providing adequate side ditches and culverts help protect roads from flood damage and also help compensate for the low strength of the soil.

This soil is assigned to capability units IIw-4, dryland, and IIw-6, irrigated, to the Saline Subirrigated range site, and to windbreak suitability group 9S.

ChD—Colby silt loam, 6 to 9 percent slopes. This is a deep, strongly sloping, well drained soil on side slopes of deeply entrenched drainageways on uplands. Small rills are common, and there are a few gullies. Narrow bottom lands are along the drainageways. The areas of this soil range from 15 to 320 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. Below that, there is a transition layer of light brownish gray, very friable silt loam about 6 inches thick. The underlying material is light gray silt loam to a depth of more than 60 inches. In a few small areas, the surface layer is loam or very fine sandy loam.

Included with this soil in mapping are small areas of Ulysses soils, which are well drained and are on the upper part of the slope. Also included are areas of alluvial material on narrow bottom lands along the drainageways. The included areas make up 10 to 15 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is medium to rapid. The content of organic matter is low. This soil contains lime throughout.

About half of the acreage of this soil is farmed, and half is used as rangeland or has been reseeded to native grasses. Under dryland management, this soil is poorly suited to wheat, corn, alfalfa, and introduced grasses. The major hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. Insufficient rainfall during the growing season is a limitation. Terraces, farming on the contour, and

grassed waterways protect the soil against serious water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help reduce water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase infiltration of water. Summer fallow is commonly used if wheat is grown.

Under sprinkler irrigation, this soil is poorly suited to corn, alfalfa, and introduced grasses. Water erosion and soil blowing are the main hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and also conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can result in severe soil losses from water erosion. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in farmstead and livestock windbreaks. Trees and shrubs that tolerate a high calcium content and withstand drought are best adapted. Water erosion is a hazard. Competition for moisture from grasses and weeds and droughty conditions are the main concerns in establishing seedlings. Irrigation can supply moisture in periods of insufficient rainfall. Cultivation between the rows with tillage equipment helps to control undesirable grasses and weeds. Annual cover crops between the rows help to control erosion. Trees can be planted on the contour in combination with terraces to help prevent excessive erosion and runoff.

This soil generally is suited to septic tank absorption fields and sites for houses. Sewage lagoons need to be lined or sealed to prevent seepage, and extensive grading is required to modify the slope and shape the lagoon. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. Roads and streets need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance.

This soil is assigned to capability units IVe-9, dryland, and IVe-6, irrigated, to the Limy Upland range site, and to windbreak suitability group 8.

ChF—Colby silt loam, 9 to 30 percent slopes. This is a deep, steep, somewhat excessively drained soil on uneven side slopes of deeply entrenched upland canyons. Narrow bottom lands are along the natural drainageways. The areas of this soil range from 20 to 1,000 acres in size.

Typically, the surface layer is light brownish gray, very friable silt loam about 4 inches thick. The layer below that is light gray, very friable silt loam about 4 inches thick. The underlying material is very pale brown silt loam to a depth of more than 60 inches. In a few small areas, the soil is loam or very fine sandy loam throughout.

Included with this soil in mapping are small areas of Canyon, Otero, and Ulysses soils. Also included are small narrow areas of bottom lands adjacent to natural drainageways at the bottom of the canyons. Canyon soils are shallow over weakly cemented caliche and are on the lower part of side slopes below the Colby soil. Otero soils are coarser textured than the Colby soil and are below the Colby soil on the landscape. Ulysses soils, unlike the Colby soil, have a dark surface layer and a subsoil, and they are on the upper part of side slopes above the Colby soil. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderate, and the available water capacity is high. The content of organic matter is low. Runoff is medium to rapid, depending on the kind and amount of vegetation. This soil is limy throughout.

Most of the acreage of this soil is in native grasses, which are used for grazing. This soil is too steep and susceptible to water erosion for use as cropland. It should be tilled only when necessary in reseeding to native grasses.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can result in severe soil losses from water erosion. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil generally is not suited to trees and shrubs in windbreaks. It is highly susceptible to water erosion because of the steep slope. In some areas, trees and shrubs that tolerate a high content of lime can be planted by hand or by other special methods to provide habitat for wildlife.

This soil generally is not suited to sanitary facilities because of the steep slope. If it is necessary to construct sanitary facilities on this soil, they should be located on the smoother, less sloping sites. Houses should be designed to accommodate the natural slope of the land. Land shaping may be necessary in some areas. Roads need to be designed so that the pavement and subbase are thick enough to compensate for the low

strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance. Cuts and fills generally are needed to provide a suitable grade for roads and streets.

This soil is assigned to capability unit VIe-9, dryland, to the Limy Upland range site, and to windbreak suitability group 10.

ChG—Colby silt loam, 30 to 60 percent slopes. This is a deep, somewhat excessively drained soil on very steep side slopes of deeply entrenched upland canyons (fig. 7). Slopes are broken in numerous places by soil slippage or "catsteps." Narrow bottom lands are along the natural drainageways at the bottom of the canyons. The areas of this soil range from 25 to 2,500 acres.

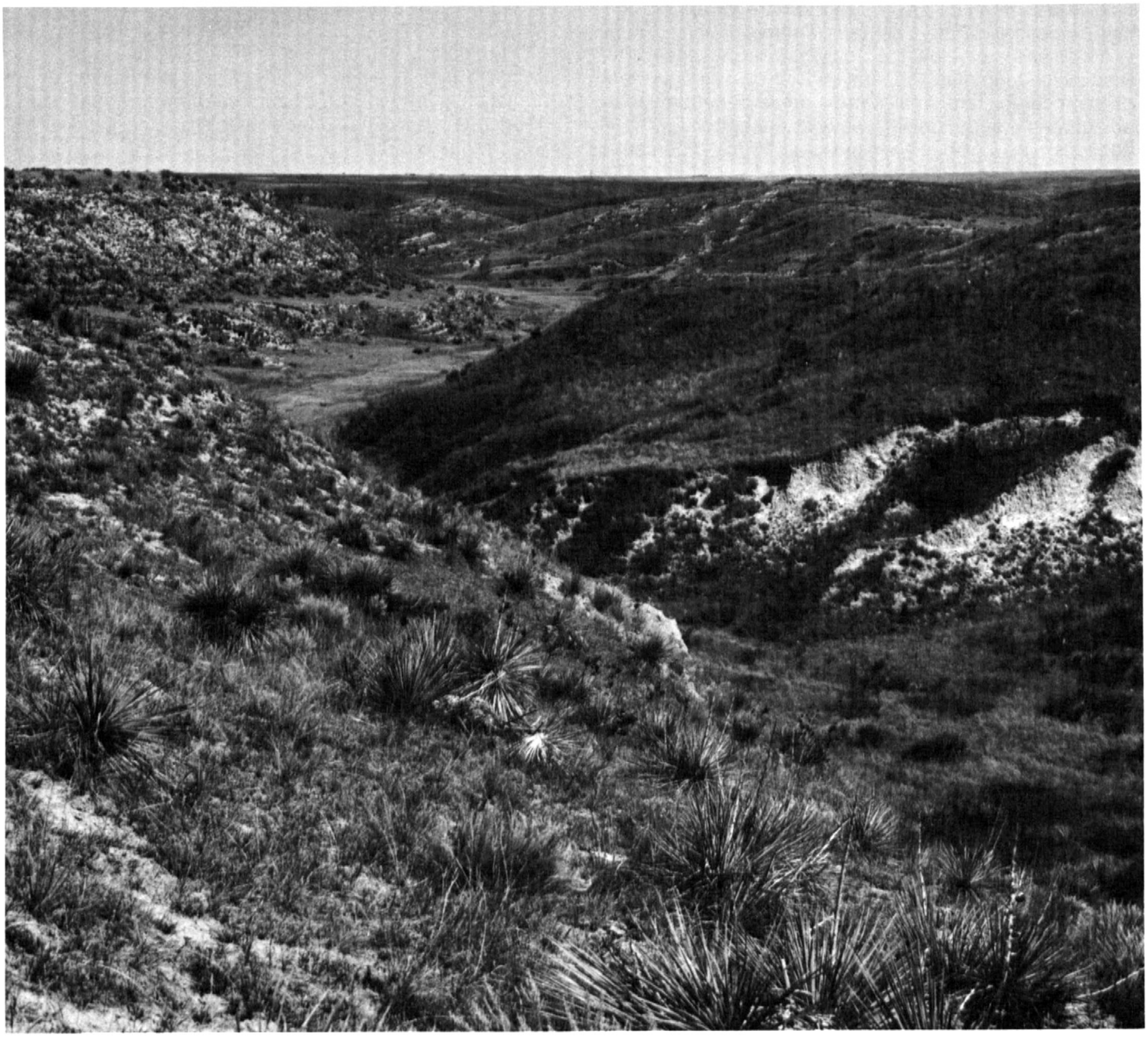

Figure 7.—Colby silt loam, 30 to 60 percent slopes, is in native grasses and is used mainly for grazing.

Typically, the surface layer is grayish brown, very friable silt loam about 4 inches thick. Below that, there is a transition layer of light brownish gray, very friable silt loam about 6 inches thick. The upper part of the underlying material is pale brown silt loam, and the lower part is very pale brown silt loam to a depth of more than 60 inches. In a few small areas, the soil is loam or very fine sandy loam throughout.

Included with this soil in mapping are small areas of Canyon and Otero soils. Canyon soils are shallow over weakly cemented caliche and are on the lower part of side slopes below the Colby soil. Otero soils are coarser textured and are below the Colby soil on the landscape. Also included in mapping, and making up 5 to 8 percent of the map unit, are small narrow areas of bottom lands adjacent to natural drainageways at the bottom of the canyons. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderate, and the available water capacity is high. The content of organic matter is low. Runoff is rapid. This soil contains lime throughout.

This soil is in native grasses, which are used for grazing. It is too steep and susceptible to water erosion to be used as cropland.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing reduces the protective cover and causes deterioration of the native plants. Proper grazing use, timely deferment of grazing, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is not suited to trees and shrubs in windbreaks because of the steepness of slopes and the susceptibility to water erosion.

This soil generally is not suited to sanitary facilities because of the very steep slopes. A substitute site is needed. Houses need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. Roads need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance. Cuts and fills generally are needed to provide a suitable grade for roads and streets.

This soil is assigned to capability unit VIIe-9, to the Thin Loess range site, and to windbreak suitability group 10.

CrB—Creighton very fine sandy loam, 1 to 3 percent slopes. This is a deep, very gently sloping, well drained soil on terraces and uplands. The areas range from 15 to 400 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 12 inches thick. The subsoil is brown, friable very fine sandy loam about 8 inches thick. The underlying material is light brownish gray very fine sandy loam in the upper part and white very fine sandy loam in the lower part to a depth of more than 60 inches. In a few small areas, the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Ascalon and Rosebud soils. Ascalon soils have a finer textured subsoil than the Creighton soil and are on similar landscapes. Rosebud soils have a finer textured subsoil and are at a slightly higher elevation than the Creighton soil. Also, Rosebud soils have weakly cemented caliche at a depth of 20 to 40 inches. The included soils make up 12 to 15 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderate. The content of organic matter is moderately low. The surface layer is easily tilled within a wide range of moisture content.

Most of the acreage is farmed, but in a few areas, the soil is in native grasses, which are grazed or mowed for hay. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for hay or pasture. Water erosion and soil blowing are the major hazards if the surface is not adequately protected by crops or crop residue. Insufficient rainfall during the growing season is a limitation. If the slopes are long and smooth enough, this soil can be terraced and farmed on the contour to prevent serious water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help to maintain or improve the content of organic matter, fertility, and tilth and also to increase infiltration of water. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, and alfalfa. Introduced grasses can be grown for hay or pasture. Soil blowing is a serious hazard if the surface is not adequately protected by crops or crop residue. Land leveling increases the efficiency of a gravity irrigation system and protects against water erosion. Timely water application and correct design increase the efficiency of a sprinkler irrigation system. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing can result in soil losses from water erosion. Proper grazing use, timely deferment of grazing or haying, and a system of

use and rest that varies from year to year help to keep the grasses in good condition.

This soil is suited to trees and shrubs in farmstead, field, and livestock windbreaks. The main hazards and limitations are droughtiness, competition for moisture from weeds and grasses, and soil blowing. Irrigation can supply moisture in periods of low rainfall. Cultivation between rows with conventional equipment and use of appropriate herbicides in the rows can help control undesirable grasses and weeds. Strips of sod or a cover crop between the rows can reduce soil blowing.

This soil generally is suited to use as sites for houses and small commercial buildings and to local roads and streets. The moderate permeability is a limitation for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon.

This soil is assigned to capability units IIe-1, dryland, and IIe-6, irrigated, to the Silty range site, and to windbreak suitability group 3.

CrC—Creighton very fine sandy loam, 3 to 6 percent slopes. This is a deep, gently sloping, well drained soil on uplands. The areas range from 15 to 600 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 6 inches thick. The subsurface layer is brown, very friable very fine sandy loam about 6 inches thick. The subsoil is pale brown, very friable very fine sandy loam about 6 inches thick. The underlying material is very pale brown very fine sandy loam to a depth of more than 60 inches. In some areas the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Ascalon and Rosebud soils. Ascalon soils are on a landscape similar to that of the Creighton soil; they have a finer textured subsoil than that of the Creighton soil. Rosebud soils have a finer textured subsoil, have weakly cemented caliche at a depth of 20 to 40 inches, and are in a slightly higher position than that of the Creighton soil. The included soils make up about 12 to 15 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is medium. The water intake rate is moderate. The content of organic matter is moderately low. The surface layer is easily tilled within a wide range of moisture content.

Most of the acreage is farmed, but in a few areas, the soil is in native grasses, which are grazed or mowed for hay. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for hay or pasture. Water erosion and soil blowing are the major hazards if the soil is not adequately protected by crops or crop residue. Insufficient rainfall during the growing season is a limitation. If the slopes are long and smooth enough, this soil can be terraced and farmed on the contour to prevent serious water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase infiltration of water. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses for hay or pasture. Water erosion and soil blowing are hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase infiltration of water.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing can also result in severe soil losses from water erosion. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in farmstead, field, and livestock windbreaks. The main limitations and hazards are slope, droughtiness, competition for moisture from weeds and grasses, and soil blowing. Trees can be planted on the contour in combination with terraces to help prevent erosion and excessive runoff. Growth may be somewhat slower on the steepest slopes. If irrigation is practical, it can supply moisture in periods of low rainfall. Cultivation in the tree rows and appropriate herbicides can help control undesirable grasses and weeds. Strips of sod or a cover crop between the rows can reduce soil blowing.

This soil generally is suited to use as a site for houses and for local roads and streets. The moderate permeability of this soil is a limitation for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-6, irrigated, to the Silty range site, and to windbreak suitability group 3.

CrD—Creighton very fine sandy loam, 6 to 11 percent slopes. This is a deep, strongly sloping, well drained soil on uplands. The areas range from 15 to 600 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 12 inches thick. The subsoil is brown, very friable very fine sandy loam about 6 inches thick. The underlying material is very pale brown very fine sandy loam to a depth of more than 60 inches. In a few small areas, the surface layer is fine sandy loam.

Included with this soil in mapping are small areas of Colby and Rosebud soils. Colby soils have less sand than the Creighton soil, do not have a dark surface layer, and are in higher positions on the landscape. Rosebud soils have a finer textured subsoil, have weakly cemented caliche at a depth of 20 to 40 inches, and are at a slightly higher elevation than the Creighton soil. The included soils make up about 10 to 15 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is medium. The water intake rate is moderate. The content of organic matter is moderately low. The surface layer is easily tilled within a wide range of moisture content.

Most of the acreage is farmed, but a few areas are in native grasses, which are grazed or mowed for hay. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for hay or pasture. Water erosion and soil blowing are the major hazards if the surface is not adequately protected by crops or crop residue. Insufficient rainfall during the growing season is a limitation. If the slopes are long and smooth enough, this soil can be terraced and farmed on the contour to prevent serious water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase infiltration of water. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses for hay or pasture. Water erosion and soil blowing are hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion and conserve moisture. Timely water application and correct design increase the efficiency of a sprinkler irrigation system. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing can also result in severe soil losses from water erosion. Proper grazing use, timely deferment of grazing, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in farmstead, field, and livestock windbreaks. The main hazards and limitations are slope, droughtiness, competition for moisture from weeds and grasses, and soil blowing. Trees can be planted on the contour in combination with terraces to help prevent erosion and excessive runoff. Growth may be somewhat slower on the steepest slopes. If irrigation is practical, it can supply moisture in periods of low rainfall. Cultivation in the tree rows and appropriate herbicides can help control undesirable grasses and weeds. Strips of sod or a cover crop between the rows can reduce soil blowing.

The moderate permeability of this soil is a limitation for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the field. Also, land shaping and contouring the absorption field generally are necessary. For sewage lagoons, extensive grading is required to modify the slope and shape the lagoon. Houses and small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. Cutting and filling generally are needed to provide a suitable grade for roads and streets.

This soil is assigned to capability units IVe-1, dryland, and IVe-6, irrigated, to the Silty range site, and to windbreak suitability group 3.

DbB—Dailey loamy sand, 0 to 3 percent slopes. This is a deep, nearly level and very gently sloping, somewhat excessively drained soil in upland valleys. The areas range from 25 to 360 acres in size.

Typically, the surface layer is grayish brown, very friable loamy sand about 14 inches thick. The underlying material to a depth of more than 60 inches is light yellowish brown loamy sand. In a few small areas, the surface layer is loamy fine sand or fine sand. In some areas, the dark surface layer is less than 10 inches thick.

Included with this soil in mapping are small areas of Vetal soils. The well drained Vetal soils are finer textured throughout than the Dailey soil, have a dark surface layer that is more than 20 inches thick, and are in similar positions on the landscape. The included soils make up 10 to 15 percent of the map unit.

Permeability is rapid, and the available water capacity is moderate. The water intake rate is very high. Runoff is very slow. The content of organic matter is moderately low. The surface layer is easily tilled within a wide range of moisture content. This soil releases moisture readily to plants.

Most of the acreage is in native grasses, which are used for grazing or mowed for hay, but in a few areas

the soil is cultivated. Under dryland management, this soil is poorly suited to wheat. Soil blowing is the main hazard if the surface is not adequately protected by crops or crop residue. The major limitations are inadequate rainfall during the growing season and the moderate available water capacity. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, this soil is suited to corn, grain sorghum, alfalfa, and introduced grasses. Soil blowing is the major hazard if the surface is not adequately protected by crops or crop residue. The major limitations are the rapid permeability and low natural fertility. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve moisture. Proper water application rate and timely application increase the efficiency of a sprinkler irrigation system. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can cause severe losses from soil blowing and create small blowouts. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in farmstead, livestock, and field windbreaks. The major hazards and limitations are insufficient moisture, soil blowing, and competition for moisture from weeds and undesirable grasses. Irrigation can supply moisture in periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or a cover crop between the tree rows. Weeds and undesirable grasses can be controlled by cultivation between the rows with conventional equipment. Appropriate herbicides can be applied in the row, or the area can be hoed by hand.

This soil generally is suited to use as a site for houses and small commercial buildings and for local roads and streets. Seepage from septic tank absorption fields can contaminate the ground water. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is assigned to capability units IVe-5, dryland, and IVe-11, irrigated, to the Sandy range site, and to windbreak suitability group 5.

DuC—Duda-Tassel loamy sands, 3 to 6 percent slopes. This complex consists of moderately deep, well drained Duda soil and shallow, well drained Tassel soil. Both soils are gently sloping to undulating and are on uplands. The Duda soil is on the top and on the sides of hummocks, and the Tassel soil is between the hummocks. The areas of these soils are so intricately mixed or so small that it was not practical to map them separately. The mapped areas of this complex range in size from 15 to 640 acres and are about 50 to 60 percent Duda soil and 20 to 30 percent Tassel soil.

Typically, the Duda soil has a surface layer of dark grayish brown, very friable loamy sand about 7 inches thick. A transition layer below the surface layer is brown, loose loamy fine sand about 7 inches thick. The underlying material is brown fine sand to a depth of 28 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few areas, the surface layer is loamy fine sand or sand.

Typically, the Tassel soil has a surface layer of grayish brown, loose loamy sand about 5 inches thick. The subsurface layer is light brownish gray, very friable fine sandy loam about 5 inches thick. The underlying material is light gray fine sandy loam to a depth of 16 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is fine sandy loam or loamy fine sand.

Included with these soils in mapping are small areas of Dailey and Valent soils. Dailey soils are deep and somewhat excessively drained and are in lower positions on the landscape than the Duda soil. Valent soils are deep and excessively drained and commonly are in higher positions than the Duda soil. The included soils make up 10 to 15 percent of areas of the complex.

Permeability is rapid in the Duda soil and moderately rapid in the Tassel soil. The available water capacity of these soils is very low. The content of organic matter is low.

Most of the acreage of these soils is in native grasses, but a few acres are in irrigated crops. These soils generally are not suited to dryfarming because they are highly susceptible to soil blowing and have a very low available water capacity. Also, they are moderately deep and shallow to bedrock.

Under sprinkler irrigation, these soils are suited to corn, alfalfa, and introduced grasses for hay or pasture. Soil blowing is the major hazard if the surface is not adequately protected by crops or crop residue. The main limitation is the very low moisture supply. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve soil moisture. Timely water application and proper application rate increase the efficiency of a sprinkler irrigation system. Crop residue, green manure crops, and feedlot

manure help maintain or improve the content of organic matter and fertility.

These soils are suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can cause severe soil losses from soil blowing and create small blowouts. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

The Duda soil in this complex is suited to trees and shrubs in windbreaks, but special practices are required. The Tassel soil is not suited because of shallowness to bedrock and the very low available water capacity. The limitations and hazards for the Duda soil are the loose surface layer, soil blowing, covering of seedlings by drifting sand in high winds, the very low moisture supply, and competition for moisture from weeds and undesirable grasses. Planting the trees and shrubs by hand with minimal disturbance of the soil helps prevent soil blowing. Irrigation can supply moisture. Competing weeds and grasses can be controlled by hand hoeing in areas near the trees.

The Duda soil generally is suited to use as sites for houses without basements and to local roads and streets. The Tassel soil generally is not suited to septic tank absorption fields because of shallowness to bedrock. A substitute site is needed. On the Duda soil, building up or mounding the septic tank absorption field site with suitable fill material increases the filtering capacity of the field. Seepage can contaminate the ground water. The Tassel soil generally is not suited to sewage lagoons because of its shallowness to bedrock. A substitute site is needed. Sewage lagoons can be constructed on the Duda soil if they are lined or sealed to prevent seepage. On the Duda soil, the walls or sides of shallow excavations can be shored to prevent sloughing or caving. On Tassel and Duda soils, the soft bedrock generally can be easily excavated for construction of houses with basements or for buildings that have deep foundations. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. On the Tassel soil, the soft bedrock needs to be excavated in constructing roads and streets.

The soils in this complex are assigned to capability units VIe-5, dryland, and IVe-11, irrigated. The Duda soil is in the Sandy range site and in windbreak suitability group 7. The Tassel soil is in the Shallow Limy range site and in windbreak suitability group 10.

Fu—Fluvaquents, silty. These soils are deep and level and are very poorly drained. They are in low areas on bottom lands. These soils usually are covered by 3 to 12 inches of water. Areas commonly are long and narrow and range from 5 to 80 acres in size.

Typically, the surface layer consists of decaying organic matter; it is about 12 inches thick. The underlying material is dark gray and very dark gray silt loam to a depth of more than 60 inches. The texture, color, and thickness of these soils vary from one area to another.

Included with these soils in mapping are small areas of Gannett and Gibbon soils. Gannett soils are in slightly higher positions and do not have water covering the surface. Gibbon soils are somewhat poorly drained and have a water table at a depth of 1.5 to 3 feet. The included soils make up less than 10 percent of the map unit.

Permeability is moderate. Runoff is ponded. The available water capacity is high. The content of organic matter is very high.

All of the acreage of these soils is in cattails, rushes, and other semiaquatic plants. The areas provide good habitat for wetland wildlife and waterfowl.

These soils are not suited to crops, grasses, or trees. They are also not suited to sanitary facilities or building site development.

These soils are assigned to capability unit VIIIw-7 and windbreak suitability group 10.

Gb—Gannett silt loam, overwash, 0 to 2 percent slopes. This is a deep, nearly level, very poorly drained soil in ponded areas on bottom lands. The areas range from 5 to 150 acres in size.

Typically, the surface layer is covered by about 11 inches of overwash material that is light gray, very friable silt loam in the upper part and gray, mottled, friable silt loam in the lower part. The original surface layer, between depths of 11 and 30 inches, is dark gray, friable silt loam. The subsurface layer is dark gray, friable very fine sandy loam about 20 inches thick. The underlying material is stratified, dark gray, gray, and light gray very fine sandy loam to a depth of more than 60 inches. There is lime throughout the soil.

Included with this soil in mapping are small areas of the very poorly drained Fluvaquents, silty, which usually are covered by shallow water. Also included are areas of Gibbon soils, which are somewhat poorly drained and have a water table at a depth of 1.5 to 3.0 feet. Also included are areas of the somewhat poorly drained Wann soils, which are sandier throughout than the Gannett soil. All the included soils are at a slightly higher elevation than the Gannett soil. The included soils make up less than 10 percent of the map unit.

Permeability is moderate. Runoff is very slow or is ponded. The available water capacity is high. The content of organic matter is high. The seasonal high water table ranges from 6 inches above the surface in wet years to a depth of 1 foot in dry years.

Most of the acreage is in native grasses, which are mowed for hay (fig. 8). In some areas, the soil is used for grazing during dry periods. The soil is not suited to cultivation because it is too wet.

This soil is suited to range or native hay. Improper haying time and improper mowing height reduce the protective cover and cause deterioration of the native plants.

This soil is not suited to trees and shrubs in windbreaks because of wetness.

This soil is not suited to sanitary facilities, building site development, and local roads because of ponding.

This soil is assigned to capability unit Vw-7, to the Wet Land range site, and to windbreak suitability group 10.

Gf—Gibbon silt loam, 0 to 2 percent slopes. This is a deep, nearly level, and somewhat poorly drained soil on bottom lands. It is occasionally flooded. The areas range in size from 15 to 200 acres.

Typically, the surface layer is dark grayish brown, friable, calcareous silt loam about 9 inches thick. Below that, there is a transition layer of light brownish gray, mottled, very friable, calcareous silt loam about 6 inches thick. The underlying material is stratified and calcareous. It is light gray, mottled very fine sandy loam; grayish brown, mottled silt loam; and, to a depth of more than 60 inches, white, mottled very fine sandy loam. In some areas, the surface layer is very fine sandy loam or loam. Also, in places, the lower part of the underlying material is fine sandy loam. In some areas, the soil has a higher content of clay.

Included with this soil in mapping are small areas of Fluvaquents, which are very poorly drained and usually are covered by 3 to 12 inches of water. These soils are below the Gibbon soil on the landscape. Also included are small areas of Gannett soils. Gannett soils are very poorly drained, and they are at a lower elevation than

Figure 8.—Gannett silt loam, overwash, 0 to 2 percent slopes, is used mainly for hay. The uncut grasses are on Fluvaquents, silty.

the Gibbon soil. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderate. Runoff is slow. The available water capacity is high. The content of organic matter is moderate. The water intake rate for irrigation is moderate. The seasonal high water table ranges from a depth of about 1.5 feet in wet years to a depth of 3 feet in dry years.

Most of the acreage of this soil is in native grasses, which are used for grazing or mowed for hay. In a few areas the soil is dry-farmed, and in others it is irrigated.

Under dryland management, this soil is suited to wheat, alfalfa, and introduced grasses. Occasional flooding is a hazard. Dams, dikes, and diversions can be used to protect fields from occasional flooding. A major limitation is wetness caused by the water table. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth.

Under irrigation by either gravity or sprinkler systems, this soil is suited to corn, alfalfa, sugar beets, and pinto beans. The main hazard is occasional flooding, and the major limitation is wetness caused by the water table. Dikes around the area can prevent flooding. Tile drainage helps lower the water table. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, either grazing or haying. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. In addition, when the soil is wet, overgrazing can cause surface compaction and the formation of small mounds, making grazing or hay harvesting difficult. Proper grazing use and timely deferment of grazing or haying, along with restricted use during very wet periods, help maintain the native plants in good condition.

This soil is suited to adapted trees and shrubs in all types of windbreaks and shelterbelts. Trees and shrubs that tolerate occasional wetness generally survive and grow well. The herbaceous vegetation that grows on this soil is abundant and persistent. Weeds and grasses can be controlled by cultivating between the rows with conventional equipment. Appropriate herbicides can be used in the tree rows. Areas close to the trees can be hoed by hand or rototilled. Establishing seedlings can be a problem in wet years. The soil can be tilled and the seedlings planted after the soil has dried.

This soil is not suited to building sites or septic tank absorption fields because of flooding. Sewage lagoons need to be diked for protection against flooding; they should be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table. Also, lagoons need to be sealed or lined to prevent seepage. Constructing roads on suitable, well compacted fill material above flood level and providing adequate side ditches and culverts help protect roads against flood damage and wetness. Good surface drainage and a gravel moisture barrier in the subgrade can reduce damage to roads caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIw-4, dryland, and IIw-6, irrigated, to the Subirrigated range site, and to windbreak suitability group 2S.

Gh—Goshen silt loam, 0 to 1 percent slopes. This is a deep, nearly level, well drained soil in concave swales on uplands. It is subject to rare flooding. The areas range from 15 to 1,200 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsurface layer is dark grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 26 inches thick. The upper part is dark grayish brown, friable silty clay loam; the middle part is grayish brown, friable silty clay loam; and the lower part is light brownish gray, friable, calcareous silt loam. The upper part of the underlying material, to a depth of 48 inches, is light gray, calcareous silt loam. The lower part is very pale brown, calcareous silt loam to a depth of more than 60 inches. In a few small areas, the subsoil contains a dark buried soil. In a few places, weakly cemented limestone is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Alliance, Keith, and Scott soils. Alliance and Keith soils are in higher positions on the landscape than the Goshen soil. Also, the dark color of the surface layer in Alliance and Keith soils extends to a depth of less than 20 inches. Alliance soils have weakly cemented caliche at a depth of 40 to 60 inches. Scott soils are finer textured than the Goshen soil and are in small depressions. The included soils make up 3 to 8 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderately low. The content of organic matter is moderate. The surface layer is easily tilled within a wide range of moisture content.

This soil is mainly farmed. Under dryland management, it is suited to wheat and grain sorghum. Introduced grasses can be grown for pasture or mowed for hay. The main limitation is inadequate rainfall during the growing season. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve fertility and the content of organic matter. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, alfalfa, sugar beets, and pinto beans. Introduced grasses and legumes can be grown for pasture or mowed for hay. Soil blowing is the main hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and conserve moisture. Correct design and proper rate of water application increase the efficiency of an irrigation system. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to adapted trees and shrubs in farmstead, livestock, and field windbreaks. Irrigation can supply moisture in periods of low rainfall. Competition for moisture from weeds and grasses can be controlled by cultivation between the rows and by the use of appropriate herbicides in the row. Weeds in the row or near small trees can be hoed by hand or rototilled. A cover crop between the rows can reduce soil blowing.

Rare flooding is a hazard if this soil is used for sanitary facilities and building sites. The moderate permeability of this soil is a limitation for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Sewage lagoons need to be diked for protection against flooding. Houses and small commercial buildings can be constructed on raised and well compacted fill material for protection against flooding. Roads need to be designed so that the pavement and subbase are thick enough to compensate for the low soil strength. Coarser material can be used for subgrade or base material to ensure better performance. Constructing roads on suitable, well compacted fill material above flood level and providing adequate side ditches and culverts help protect roads from flood damage.

This soil is assigned to capability units IIc-1, dryland, and I-4, irrigated, to the Silty range site, and to windbreak suitability group 1.

HaB—Haxtun loamy fine sand, 0 to 3 percent slopes. This is a deep, nearly level to very gently sloping, well drained soil in valleys on uplands. The areas range from 15 to 500 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 13 inches thick. The subsoil is about 35 inches thick. The upper part is grayish brown, very friable fine sandy loam, and the middle part is light brownish gray, very friable sandy clay loam over a buried layer of dark grayish brown, very friable sandy clay loam. The lower part of the subsoil is light brownish gray, very friable loam. The underlying material to a depth of more than 60 inches is very pale brown, calcareous very fine sandy loam. In a few small areas, the surface layer is loamy sand, fine sandy loam, or sandy loam. In some areas, there is no buried soil.

Included with this soil in mapping are small areas of Jayem and Vetal soils. Jayem soils are coarser textured throughout than the Haxtun soil; they do not have a buried soil, and the dark color of the surface layer extends to a depth of less than 20 inches. They are in slightly higher positions on the landscape. Vetal soils are on about the same kind of landscape as the Haxtun soil, but they are coarser textured throughout and do not have a buried soil. The included soils make up 8 to 12 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is slow, and the water intake rate is high. The content of organic matter is moderately low. This soil is easily tilled within a wide range of moisture content. It releases moisture readily to plants.

About half of the acreage of this soil is rangeland. The grasses are grazed or are mowed for hay. The rest is farmed. Under dryland management, this soil is suited to wheat and introduced grasses for hay or pasture. The main hazard is soil blowing if the surface is not adequately protected by crops or crop residue. The main limitation is inadequate rainfall during the growing season. Stubble mulching, chiseling, discing, and other conservation tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses for hay or pasture. The main hazard is soil blowing if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Severe losses from soil blowing and small blowouts can also result. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help to maintain or improve the range condition.

This soil is suited to trees and shrubs in farmstead, field, and livestock windbreaks. Soil blowing is a severe hazard. Native vegetation or a cover crop between the tree rows helps control soil blowing. Undesirable grasses and weeds can be controlled by cultivation between the rows and by herbicides.

The moderate permeability of this soil is a limitation to its use as septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the

field. Sewage lagoons need to be lined or sealed to prevent seepage. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. The base material for roads and streets can be mixed with additives, for example, hydrated lime, to help prevent shrinking and swelling.

This soil is assigned to capability units IIIe-5, dryland, and IIIe-10, irrigated, to the Sandy range site, and to windbreak suitability group 5.

HdB—Haxtun fine sandy loam, 0 to 3 percent slopes. This is a deep, nearly level to very gently sloping, well drained soil in valleys on uplands. The areas range from 15 to 500 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 11 inches thick. The subsoil is about 39 inches thick. The upper part is grayish brown, friable loam; the middle part is a buried layer of dark grayish brown, friable loam; and the lower part is pale brown, very friable very fine sandy loam. The underlying material to a depth of more than 60 inches is light yellowish brown loamy very fine sand. In a few small areas, the surface layer is sandy loam or loam. In some areas, there is no buried soil.

Included with this soil in mapping are small areas of Jayem and Vetal soils. Jayem soils are in slightly higher positions on the landscape than the Haxtun soil, are coarser textured throughout, and do not have a buried soil. In Jayem soils, the dark color of the surface layer extends to a depth of less than 20 inches. Vetal soils are on about the same kind of landscape as the Haxtun soil, but they are coarser textured throughout and do not have a buried soil. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is slow, and the water intake rate is moderate. The content of organic matter is moderate. This soil releases moisture readily to plants.

Most of the acreage is farmed. A few areas are in native grasses, which are used for grazing or mowed for hay. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for hay or pasture. The main hazard is soil blowing if the surface is not adequately protected by crops or crop residue. The shortage of rainfall during the growing season is a limitation. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

Under irrigation, this soil is suited to corn, grain sorghum, sugar beets, pinto beans, alfalfa, and introduced grasses for hay or pasture. The main hazard is soil blowing if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Severe losses from soil blowing and small blowouts can also result. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help to maintain or improve the range condition.

This soil is suited to trees and shrubs in farmstead, field, and livestock windbreaks. Soil blowing is the major hazard, and limited rainfall is the major limitation. A cover crop between the tree rows helps control soil blowing. Undesirable grasses and weeds can be controlled by cultivation between the rows and by herbicides. Irrigation can supply moisture in periods of low rainfall.

The moderate permeability of this soil is a limitation for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the field. Sewage lagoons need to be lined or sealed to prevent seepage. Foundations for buildings need to be strengthened and backfilled with coarse material to prevent damage resulting from the shrinking and swelling of the soil. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. The base material for roads and streets can be mixed with additives, such as hydrated lime, to help prevent shrinking and swelling.

This soil is assigned to capability units IIe-3, dryland, and IIe-5, irrigated, to the Sandy range site, and to windbreak suitability group 5.

JaB—Jayem loamy fine sand, 0 to 3 percent slopes. This is a deep, nearly level to very gently sloping, well drained soil on ridges, side slopes, and undulating uplands. The areas range from 15 to 600 acres in size.

Typically, the surface layer is dark grayish brown, very friable loamy fine sand about 12 inches thick. The upper part of the subsoil is brown, very friable fine sandy loam about 6 inches thick. The lower part of the subsoil is pale brown, very friable fine sandy loam about 6 inches thick. The underlying material is pale brown fine sandy loam to a depth of more than 60 inches. In a few small areas, the surface layer is loamy sand or fine sand. In

some areas, the dark surface soil is more than 20 inches thick.

Included with this soil in mapping are small areas of Valent soils. Valent soils have more sand throughout and are in slightly higher positions on the landscape than the Jayem soil. The included soils make up 12 to 15 percent of the map unit.

Permeability is moderately rapid, and the available water capacity is moderate. Runoff is slow, and the intake rate for irrigation water is high. The content of organic matter is moderately low. The soil is easily tilled within a wide range of moisture content.

Most of the acreage is rangeland. The grasses are used for grazing or are mowed for hay. A few acres are farmed. Under dryland management, this soil is suited to wheat. Soil blowing is the major hazard if the surface is not adequately protected by crops or crop residue. The shortage of rainfall during the growing season is a limitation. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, legumes, and introduced grasses for hay or pasture. The major hazards are soil blowing and water erosion if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Severe losses from soil blowing and small blowouts can also result. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in farmstead, livestock, and field windbreaks. The rate of survival and growth of adapted trees is moderate. The main hazards and limitations are the lack of moisture, soil blowing, and competition for moisture from weeds and grasses. Irrigation can supply moisture in periods of low rainfall. Maintaining strips of sod or a cover crop between the tree rows helps control soil blowing. Appropriate herbicides used near the trees and cultivation between the tree rows can help control undesirable grasses and weeds.

This soil generally is suited to septic tank absorption fields, sites for houses and small commercial buildings, and local roads and streets. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is assigned to capability units IVe-5, dryland, and IIIe-10, irrigated, to the Sandy range site, and to windbreak suitability group 5.

JaC—Jayem loamy fine sand, 3 to 6 percent slopes. This is a deep, gently sloping, well drained soil on ridges, side slopes, and undulating uplands. The areas range from 15 to 150 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 10 inches thick. The upper part of the subsoil is brown, very friable fine sandy loam about 8 inches thick. The lower part of the subsoil is pale brown, very friable fine sandy loam about 6 inches thick. The underlying material is pale brown fine sandy loam to a depth of more than 60 inches. In a few small areas, the surface layer is loamy sand. In a few small areas, the dark surface layer is less than 10 inches thick.

Included with this soil in mapping are small areas of Valent soils. Valent soils have more sand throughout and are on about the same kind of landscape as the Jayem soil. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderately rapid, and the available water capacity is moderate. The intake rate for irrigation water is high, and runoff is slow. The content of organic matter is moderately low. This soil releases moisture readily to plants. The soil is easily tilled within a wide range of moisture content.

Most of the acreage is rangeland, and the grasses are grazed or mowed for hay. A small acreage is farmed. Under dryland management, this soil is suited to wheat. The main hazards are soil blowing and water erosion if the surface is not adequately protected by crops or crop residue. Insufficient rainfall during the growing season is a limitation. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, this soil is suited to corn, alfalfa, and introduced grasses for hay or pasture. Water erosion and soil blowing are the major hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Severe losses from soil blowing and small blowouts can also result. Proper grazing use, timely deferment of grazing, and a system of use and rest that varies from year to year help to maintain or improve the range condition.

This soil is suited to trees and shrubs in farmstead, livestock, and field windbreaks. The major hazards and limitations are insufficient moisture, soil blowing, competition for moisture from weeds and grasses, and slope and excessive runoff. Irrigation can supply moisture in periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or a cover crop between the tree rows. Weeds and grasses between the rows can be controlled by cultivating with conventional equipment. In the rows, appropriate herbicides can be applied or the areas can be hand-hoed. Trees planted on the contour in combination with terraces help prevent erosion and excessive runoff.

This soil generally is suited to use as building sites and to septic tank absorption fields and local roads and streets. Sewage lagoons need to be lined or sealed to prevent seepage. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. The walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is assigned to capability units IVe-5, dryland, and IVe-10, irrigated, to the Sandy range site, and to windbreak suitability group 5.

JcB—Jayem fine sandy loam, 0 to 3 percent slopes. This is a deep, nearly level to very gently sloping, well drained soil on ridges and side slopes on uplands. The areas of this soil range from 15 to 600 acres in size.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 11 inches thick. The subsoil is brown, very friable fine sandy loam about 10 inches thick. The underlying material is yellowish brown fine sandy loam in the upper part and light yellowish brown loamy fine sand in the lower part to a depth of more than 60 inches. In a few small areas, the surface layer is sandy loam. In some areas, the dark surface layer is more than 20 inches thick.

Included with this soil in mapping are small areas of Creighton, Valent, and Vetal soils. Creighton soils are calcareous and are on about the same kind of landscape as the Jayem soil. Valent soils are in higher positions on the landscape and have more sand throughout. Vetal soils are at a lower elevation than the Jayem soil, and the dark color of the surface layer extends to a depth of more than 20 inches. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderately rapid, and the available water capacity is high. The intake rate for irrigation water is moderately high, and runoff is slow. The content of organic matter is moderately low. This soil releases moisture readily to plants and is easily tilled within a wide range of moisture content.

About 60 percent of the acreage is rangeland; the grasses are grazed or are mowed for hay. About 40 percent of the acreage is farmed. Most of the cropland is irrigated.

Under dryland management, this soil is suited to wheat and grain sorghum. Soil blowing and water erosion are the main hazards if the surface is not adequately protected by crops or crop residue. Insufficient rainfall during the growing season is a limitation. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, legumes, and introduced grasses for hay or pasture. Soil blowing is the main hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause the native plants to deteriorate. Severe soil losses from soil blowing and small blowouts can also result. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in windbreaks. The rate of survival and growth of adapted trees is moderate. The major hazards and limitations are insufficient moisture, soil blowing, and competition for moisture from weeds and grasses. Irrigation can supply moisture in periods of low rainfall. Native vegetation or a cover crop between the rows of trees helps control soil blowing. Undesirable grasses and weeds can be controlled by cultivating between the rows with conventional equipment or by using appropriate herbicides.

This soil generally is suited to septic tank absorption fields and local roads and streets and to use as sites for houses and small commercial buildings. Sewage lagoons need to be lined or sealed to prevent seepage. The

walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is assigned to capability units IIIe-3, dryland, and IIe-8, irrigated, to the Sandy range site, and to windbreak suitability group 5.

JcC—Jayem fine sandy loam, 3 to 6 percent slopes. This is a deep, gently sloping, well drained soil on ridges, side slopes, and undulating uplands. The areas of this soil range from 15 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The subsoil is pale brown, very friable fine sandy loam about 9 inches thick. The underlying material is very pale brown fine sandy loam to a depth of more than 60 inches. In a few small areas, the surface layer is sandy loam or loamy sand.

Included with this soil in mapping are small areas of Creighton and Valent soils. Creighton soils are calcareous and are on similar landscapes. Valent soils have more sand throughout than the Jayem soil and are slightly higher on the landscape. The included soils make up about 5 to 8 percent of the map unit.

Permeability is moderately rapid, and the available water capacity is high. The content of organic matter is moderately low. The water intake rate for irrigation is moderately high. Runoff is medium. This soil releases moisture readily to plants.

Most of the acreage is rangeland. The grasses are used for grazing or are mowed for hay. A small acreage is farmed. Under dryland management, this soil is suited to wheat. Soil blowing and water erosion are the major hazards if the surface is not adequately protected by crops or crop residue. Insufficient rainfall during the growing season is a limitation. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, legumes, and introduced grasses for hay or pasture. The major hazards are soil blowing and water erosion if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion and conserve moisture. Timely water application and a properly designed sprinkler system guard against serious water erosion. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause the native plants to deteriorate. Overgrazing can result in severe losses from soil blowing and create small blowouts. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help to maintain or improve the range condition.

This soil is suited to trees and shrubs in windbreaks. The rate of survival and growth of adapted trees is moderate. The major hazards and limitations are insufficient moisture, soil blowing, competition for moisture from weeds and grasses, and slope and excessive runoff. Irrigation can supply moisture in periods of low rainfall. Soil blowing can be controlled by maintaining strips of sod or a cover crop between the tree rows. Cultivation generally needs to be restricted to the tree rows. Weeds and grasses can be controlled by the use of appropriate herbicides. Trees can be planted on the contour in combination with terraces to help prevent erosion and excessive runoff.

This soil generally is suited to use as septic tank absorption fields and sites for houses and to local roads and streets. Sewage lagoons need to be lined or sealed to prevent seepage. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. The walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is assigned to capability units IVe-3, dryland, and IIIe-8, irrigated, to the Sandy range site, and to windbreak suitability group 5.

KeB—Keith silt loam, 1 to 3 percent slopes. This is a deep, very gently sloping, well drained soil on uplands. The areas range in size from 15 to 150 acres.

Typically, the surface layer is grayish brown, very friable silt loam about 6 inches thick. The subsoil is about 17 inches thick. The upper part is grayish brown, friable silty clay loam, and the lower part is pale brown, very friable silt loam. The underlying material is very pale brown silt loam to a depth of more than 60 inches. In a few small areas, the surface layer is loam.

Included with this soil in mapping are small areas of Goshen, Kuma, and Ulysses soils. In Goshen and Kuma soils, the dark color of the surface layer extends to a depth of more than 20 inches. Unlike the Keith soil, Kuma soils have a buried soil. Kuma soils are on the same kind of landscape as the Keith soil. Ulysses soils are higher on the landscape, and the subsoil is not so strongly developed as that of the Keith soil. The included soils make up 8 to 12 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is medium. The intake rate for irrigation water is moderately low. The content of organic

matter is moderate. This soil releases moisture readily to plants.

Most of the acreage of this soil is farmed. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for hay or pasture. Water erosion and soil blowing are the major hazards if the surface is not adequately protected by crops or crop residue. A shortage of rainfall during the growing season is a limitation. Terraces and grassed waterways help prevent water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase the infiltration of water. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses for hay or pasture. Water erosion and soil blowing are the major hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to adapted trees and shrubs in farmstead, livestock, and field windbreaks. The major hazards are drought, competition for moisture from weeds and undesirable grasses, water erosion, and soil blowing. Irrigation can supply moisture in periods of low rainfall. Cultivation between the tree rows with conventional equipment and use of appropriate herbicides in the row help control weeds and undesirable grasses. Trees planted on the contour in combination with terraces help prevent water erosion. A cover crop between the rows can reduce soil blowing.

This soil generally is suited to use as septic tank absorption fields and building sites for houses with basements. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Foundations for houses without basements and small commercial buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil. Roads and streets need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance.

This soil is assigned to capability units IIe-1, dryland, and IIe-4, irrigated, to the Silty range site, and to windbreak suitability group 3.

KeC2—Keith silt loam, 3 to 6 percent slopes, eroded. This is a deep, gently sloping, well drained soil on uplands. Small rills and gullies 2 to 4 inches deep are common. In a few places, erosion has removed the surface layer, exposing the silty clay loam subsoil. The areas range in size from 15 to 180 acres.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is grayish brown, friable silty clay loam, and the lower part is very pale brown, very friable silt loam. The underlying material is pale brown, calcareous silt loam in the upper part and very pale brown, calcareous silt loam in the lower part to a depth of more than 60 inches. In a few small areas the surface layer is loam or silty clay loam.

Included with this soil in mapping are small areas of Kuma and Ulysses soils. Kuma soils are below the Keith soil on the landscape; the dark color of their surface layer extends to a depth of more than 20 inches. Ulysses soils are on about the same kind of landscape, and the subsoil is not so developed as that of the Keith soil. The included soils make up 8 to 12 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is medium. The water intake rate for irrigation is moderately low. The content of organic matter is moderate. This soil releases moisture readily to plants.

Most of the acreage of this soil is farmed. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for hay or pasture. Water erosion and soil blowing are the major hazards if the surface is not adequately protected by crops or crop residue. A shortage of rainfall during the growing season is a limitation. Terraces and grassed waterways help control water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase the infiltration of water. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, this soil is suited to corn, sugar beets, pinto beans, and alfalfa. Introduced grasses can be grown for hay or pasture. Water erosion and soil blowing are the major hazards if the surface is not adequately protected by crops or crop residue. A correctly designed irrigation system and timely water application increase the efficiency of irrigation and help protect against water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to trees and shrubs in windbreaks. The main hazards are drought, competition for moisture from weeds and undesirable grasses, water erosion, and soil blowing. Irrigation can supply moisture in periods of low rainfall. Cultivation between the rows with conventional equipment and the use of appropriate herbicides in the row help control weeds and undesirable grasses. Trees planted on the contour in combination with terraces help prevent water erosion. Strips of sod or a cover crop between the tree rows can reduce soil blowing.

This soil generally is suited to septic tank absorption fields and to use as sites for houses with basements. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Foundations for houses without basements and small commercial buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. Roads and streets need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-4, irrigated, to the Silty range site, and to windbreak suitability group 3.

Ku—Kuma silt loam, 0 to 1 percent slopes. This is a deep, nearly level, well drained soil on uplands. The areas of this soil range from 15 to 5,000 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 37 inches thick. The upper part is grayish brown, very friable silt loam, and the middle part is grayish brown, friable silty clay loam over a buried soil of dark grayish brown, friable silty clay loam. The lower part of the subsoil is light brownish gray, very friable silt loam. The upper part of the underlying material is pale brown silt loam, and the lower part is very pale brown loam to a depth of more than 60 inches. In a few small areas, the surface layer is loam. Also, in a few small areas, weakly cemented limestone is at a depth of 40 to 60 inches. In some concave swales, there is no buried soil.

Included with this soil in mapping are small areas of Alliance, Keith, and Scott soils. Alliance soils are slightly higher on the landscape than the Kuma soil and do not have a buried soil. They have weakly cemented caliche at a depth of 40 to 60 inches. Keith soils do not have a buried soil and are on about the same kind of landscape as the Kuma soil. Scott soils are poorly drained and are in small depressions. They have a finer textured subsoil than that of the Kuma soil. The included soils make up 8 to 12 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is slow. The water intake rate for irrigation is moderately low. The content of organic matter is moderate. The surface layer is easily tilled. This soil releases moisture readily to plants.

Most of the acreage of this soil is farmed. Under dryland farming, this soil is suited to wheat. Introduced grasses can be grown for hay or pasture. The main limitation is inadequate rainfall during the growing season. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses for hay or pasture. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and also conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to trees and shrubs in field, farmstead, or livestock windbreaks. Inadequate rainfall during the growing season is the main concern. Undesirable grasses and weeds can be controlled by cultivating between the rows and by use of selective herbicides. Irrigation can supply moisture in periods of low rainfall. Annual cover crops between the rows can reduce soil blowing.

This soil generally is suited to use as sites for dwellings and small commercial buildings. The moderate permeability is a limitation for septic tank absorption fields, but this limitation can generally be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage. Roads and streets need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance.

This soil is assigned to capability units IIc-1, dryland, and I-4, irrigated, to the Silty range site, and to windbreak suitability group 3.

KuB—Kuma silt loam, 1 to 3 percent slopes. This is a deep, very gently sloping, well drained soil on uplands. The areas range from 10 to 1,500 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 32 inches thick. The upper part is grayish brown,

very friable silt loam, and the middle part is grayish brown, friable silty clay loam over a buried layer of dark gray, friable silt loam. The lower part of the subsoil is grayish brown, very friable silt loam. The upper part of the underlying material is light brownish gray silt loam, and the lower part is very pale brown silt loam to a depth of more than 60 inches. In a few small areas, the surface layer is loam. In some concave swales, there is no buried soil.

Included with this soil in mapping are small areas of Alliance and Keith soils. These soils are on about the same kind of landscape as the Kuma soil. Unlike the Kuma soil, Alliance soils do not have a buried soil and have weakly cemented caliche at a depth of 40 to 60 inches. Keith soils do not have a buried soil, and the color of the surface layer extends to a depth of less than 20 inches. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is medium. The water intake rate is moderately low. The content of organic matter is moderate. This soil releases moisture readily to plants.

Most of the acreage of this soil is farmed. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for pasture or hay. Water erosion and soil blowing are the main hazards if the surface is not adequately protected by crops or crop residue. The main limitation is inadequate rainfall during the growing season. Terraces and grassed waterways help control water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase infiltration of water. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses for hay or pasture. Water erosion and soil blowing are the main hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to trees and shrubs in field, farmstead, or livestock windbreaks. The principal hazards are drought, competition for moisture from weeds and undesirable grasses, water erosion, and soil blowing. Irrigation can provide needed moisture during periods of insufficient rainfall. Cultivation between the rows with conventional equipment and selective use of herbicides in the row help control weeds and undesirable grasses. Trees can be planted on the contour in combination with terraces to help prevent excessive erosion and runoff. Annual cover crops between the rows can reduce soil blowing.

This soil generally is suited to use as a site for houses and small commercial buildings. The moderate permeability is a limitation for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Roads and streets need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance.

This soil is assigned to capability units IIe-1, dryland, and IIe-4, irrigated, to the Silty range site, and to windbreak suitability group 3.

KuC—Kuma silt loam, 3 to 6 percent slopes. This is a deep, gently sloping, well drained soil on uplands. The areas of this soil range from 15 to 320 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 29 inches thick. The upper part is grayish brown, very friable silt loam, and the middle part is grayish brown, friable silty clay loam over a buried soil of dark grayish brown, friable silty clay loam. The lower part of the subsoil is grayish brown, very friable silt loam. The underlying material is light brownish gray silt loam to a depth of more than 60 inches. In a few small areas, the surface layer is loam.

Included with this soil in mapping are small areas of Keith soils on about the same kind of landscape as the Kuma soil. In Keith soils, the dark color of the surface layer extends to a depth of less than 20 inches, and there is no buried soil. The included soils make up 15 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is medium. The water intake rate for irrigation is moderately low. The content of organic matter is moderate. This soil releases moisture readily to plants.

Most of the acreage is farmed. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for pasture or hay. Water erosion and soil blowing are the main hazards if the surface is not adequately protected by crops or crop residue. Terraces and grassed waterways help control serious water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase infiltration of water. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses for hay or pasture. Water erosion and soil blowing are the main hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and also conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to trees and shrubs in field, farmstead, or livestock windbreaks. The main hazards are drought, competition for moisture from weeds and grasses, water erosion, and soil blowing. Supplemental watering can supply the needed moisture during periods of insufficient rainfall. Cultivation between the rows with conventional equipment and the use of appropriate herbicides in the row help control weeds and undesirable grasses. Trees can be planted on the contour in combination with terraces to help prevent excessive erosion and runoff. Annual cover crops between the rows can reduce soil blowing.

This soil generally is suited to use as a site for buildings. The moderate permeability is a limitation for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. Roads and streets need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-4, irrigated, to the Silty range site, and to windbreak suitability group 3.

LaB—Laird fine sandy loam, 0 to 3 percent slopes. This is a deep, nearly level to very gently sloping, moderately well drained soil on uplands. It is in swales between sandhills. The areas of this soil range from 15 to 320 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 10 inches thick. Below the surface layer there is a transition layer of light brownish gray, very friable fine sandy loam about 6 inches thick. The underlying material is light gray very fine sandy loam in the upper part and fine sandy loam in the lower part to a depth of more than 60 inches. In a few small areas, the surface layer is loamy fine sand.

Included with this soil in mapping are small areas of Creighton soils, which have a finer textured subsoil and are higher on the landscape than the Laird soil. These soils make up 2 to 5 percent of the map unit.

Permeability is moderately rapid, and the available water capacity is high. Runoff is slow. The water intake rate is moderate. The content of organic matter is moderately low. Reaction is strongly alkaline. Plants on this soil are moderately to strongly affected by soluble salts.

About half the acreage is farmed. The cropland is mainly irrigated. The rest of the acreage is in native grasses, which are grazed or mowed for hay.

Under dryland management, this soil is poorly suited to wheat. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing and other tillage methods that keep all or part of the crop residue on the soil surface help prevent soil blowing as well as conserve soil moisture. The high content of calcium carbonate and soluble salts inhibits seed germination and plant growth. Fertility needs to be balanced because the alkalinity and salinity make many nutrients unavailable. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and soil tilth and also help increase infiltration of water. Chemical amendments are needed to neutralize the alkali. The kind and amount of chemical amendments to apply can be determined by soil tests.

Under irrigation, this soil is poorly suited to most crops. However, corn and alfalfa can be grown. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. The major limitations are excessive alkalinity and salinity. A large amount of water is needed to leach the lime and salts to a lower depth. Commercial fertilizers and chemical amendments may also be needed. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and soil tilth and also help increase the infiltration of water. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve moisture.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is poorly suited to trees and shrubs in windbreaks. The main limitations and hazards are the high salinity and alkalinity of the soil, competition from undesirable grasses and weeds, difficulty in establishing seedlings in wet years, and insufficient moisture. Only those trees and shrubs that tolerate saline-alkali conditions should be planted. Cultivation can control weeds and undesirable grasses. In wet years, planting

can be delayed until the soil is sufficiently dry. Irrigation can supply moisture in periods of insufficient rainfall.

This soil is generally suited to use as sites for houses and small commercial buildings. Seepage from septic tank absorption fields can contaminate the ground water. Sewage lagoons need to be lined or sealed to prevent seepage. The walls and sides of shallow excavations can be shored to prevent sloughing or caving. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IVs-1, dryland, and IVs-6, irrigated, to the Saline Lowland range site, and to windbreak suitability group 9N.

Ma—Mace silt loam, 0 to 1 percent slopes. This is a moderately deep, nearly level, well drained soil on upland plains. The areas of this soil range from 10 to 2,000 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 18 inches thick. The upper part is grayish brown, friable clay loam; the middle part is dark grayish brown, friable silty clay loam; and the lower part is light brownish gray, very friable, calcareous silt loam. The underlying material is light gray, calcareous silt loam to a depth of 30 inches. Below that, white, calcareous weakly cemented caliche extends to a depth of more than 60 inches. In some areas, the dark color of the surface layer and of the upper and middle parts of the subsoil extends to a depth of more than 20 inches. Also, in some areas, the subsoil has more sand.

Included with this soil in mapping are small areas of Alliance, Canyon, Kuma, and Scott soils. Alliance soils are in higher positions on the landscape than the Mace soil and do not have weakly cemented caliche above a depth of 40 inches. Canyon soils are on ridgetops and knolls and have weakly cemented caliche at a depth of less than 20 inches. Kuma soils are in lower positions on the landscape, do not have bedrock above a depth of 60 inches, and have a dark buried soil. Scott soils are deep, have more clay in the subsoil, and are in depressions. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderately slow, and the available water capacity is moderate. The water intake rate is moderately low. The content of organic matter is moderate. The weakly cemented caliche restricts root development below a depth of 30 inches. The surface layer is easily tilled within a wide range of moisture content. Runoff is slow.

This soil is used mainly for crops. Under dryland management, it is suited to wheat. Introduced grasses can be grown for hay and pasture. The main limitations are the moderately deep root zone and inadequate rainfall during the growing season. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and also conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility and also increase the infiltration of water.

This soil is suited to adapted trees and shrubs in windbreaks. The rate of survival of adapted trees is good; the growth rate is moderate. Drought, competition for moisture from weeds and grasses, and soil blowing are the major hazards. Irrigation can supply moisture in periods of low rainfall. Herbicides help control undesirable grasses and weeds in the tree rows. Weeds in the row or near young trees can be hoed by hand or rototilled. A cover crop between the rows helps reduce soil blowing.

Building up or mounding the septic tank absorption field site with suitable fill material increases the filtering capacity of the field. Sewage lagoons can be contructed on this soil if the bottom of the lagoon is sealed after excavation to prevent seepage. Foundations for houses and small commercial buildings need to be strengthened and backfilled with coarse material to prevent damage caused by the shrinking and swelling of the soil. The soft bedrock generally can be easily excavated for construction of houses with basements or buildings that have deep foundations. Roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance.

This soil is assigned to capability units IIc-1, dryland, and I-4, irrigated, to the Silty range site, and to windbreak suitability group 6R.

MaB—Mace silt loam, 1 to 3 percent slopes. This is a moderately deep, very gently sloping, well drained soil on upland slopes. The areas of this soil range from 10 to 100 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is grayish brown, friable clay loam; the middle part is dark grayish brown, friable silty clay loam; and the lower part is light brownish gray, very friable silt loam. The underlying material to a

depth of 28 inches is light gray, calcareous silt loam. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few areas, the dark color of the surface layer and of the upper and middle parts of the subsoil extends to a depth of more than 20 inches. Also, in some areas the subsoil has more sand.

Included with this soil in mapping are small areas of Alliance and Canyon soils. Alliance soils are higher on the landscape than the Mace soil and do not have weakly cemented caliche above a depth of 40 inches. Canyon soils are on ridgetops and knolls and have weakly cemented caliche at a depth of less than 20 inches. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderately slow, and the available water capacity is moderate. The water intake rate is moderately low. The content of organic matter is moderate. The weakly cemented caliche restricts root development below a depth of 28 inches. The surface layer is easily tilled within a wide range of moisture content. Runoff is medium.

This soil is used mainly for crops. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for hay and pasture. The main hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. The major limitations are the moderately deep root zone and insufficient rainfall during the growing season. Terraces and grassed waterways reduce water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface reduce water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and infiltration of water. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses. The main hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. The major limitation is the moderately deep root zone. Efficient management of irrigation water is a concern. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and also conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase infiltration of water.

This soil is suited to trees and shrubs in windbreaks. The major limitations and hazards are drought, competition from weeds and grasses, the moderate available water capacity, and soil blowing. Irrigation can supply the moisture needed in periods of insufficient rainfall. Cultivating between the rows with conventional equipment can control undesirable grasses and weeds. Herbicides or hand hoeing helps control weeds in the row. Annual cover crops can control soil blowing.

Building up or mounding a septic tank absorption field site with suitable fill material increases the filtering capacity of the field. Sewage lagoons can be constructed on this soil if the bottom of the lagoon is sealed to prevent seepage. Foundations for houses and small commercial buildings need to be strengthened and backfilled with coarse material to prevent damage caused by the shrinking and swelling of the soil. The soft bedrock generally can be easily excavated for construction of houses with basements or buildings that have deep foundations. Roads and streets need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance.

This soil is assigned to capability units IIe-1, dryland, and IIe-4, irrigated, to the Silty range site, and to windbreak suitability group 6R.

Mc—Mace-Alliance silt loams, 0 to 1 percent slopes. This complex consists of a moderately deep Mace soil and a deep Alliance soil. The soils are well drained. They are nearly level and are on upland plains. These soils are in areas so intricately mixed or so small that it was not practical to map them separately. The mapped areas range from 20 to 500 acres in size and are about 45 to 55 percent Mace soil and 25 to 30 percent Alliance soil.

Typically, the Mace soil has a surface layer of grayish brown, very friable silt loam about 6 inches thick. The subsoil is about 18 inches thick. The upper part is grayish brown, friable clay loam; the middle part is dark grayish brown, friable silty clay loam; and the lower part is light brownish gray, very friable silt loam. The underlying material, to a depth of 30 inches, is light gray, calcareous silt loam. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few areas, the dark color of the surface layer and of the upper and middle parts of the subsoil extends to a depth of more than 20 inches. Also, in some areas, the subsoil has more sand.

Typically, the Alliance soil has a surface layer of grayish brown, very friable silt loam about 12 inches thick. The subsoil is about 9 inches thick. The upper part is light brownish gray, friable silty clay loam, and the lower part is light brownish gray, very friable silt loam. The underlying material, to a depth of 45 inches, is very pale brown, calcareous very fine sandy loam. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches.

Included with these soils in mapping are small areas of Canyon and Kuma soils. Canyon soils are shallow and well drained. They are on higher knolls. Kuma soils are deep and well drained. They are in lower positions on

the landscape and have a buried layer. The included soils make up 15 to 25 percent of the mapped areas.

Permeability is moderately slow. The available water capacity is moderate in the Mace soil and high in the Alliance soil. The water intake rate is moderately low. These soils have a moderate content of organic matter. Weakly cemented caliche restricts root development in the Mace soil below a depth of 30 inches.

Most of the acreage is farmed. Under dryland management, the soils are suited to wheat. Introduced grasses can be grown for hay and pasture. The major limitation is the lack of adequate rainfall during the growing season. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and also conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, these soils are suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and also conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

These soils are suited to adapted trees and shrubs in windbreaks. The survival rate of tree seedlings is good; the growth rate is moderate. Drought, competition for moisture from weeds and grasses, and soil blowing are the major hazards. Irrigation can supply moisture in periods of low rainfall. The use of appropriate herbicides in the row can help control undesirable grasses and weeds. Weeds in the row or near small trees can be eliminated by hand hoeing or rototilling. A cover crop between the rows can reduce soil blowing.

The Alliance soil generally is suited to use as sites for houses and small commercial buildings. Building up or mounding the septic tank absorption field site with suitable fill material increases the filtering capacity of the field. The moderately slow permeability of the Alliance soil is a limitation for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Sewage lagoons can be constructed on these soils if the bottom of the lagoon is sealed to prevent seepage. The walls or sides of shallow excavations on the Alliance soil can be shored to prevent sloughing or caving. Foundations for houses and small commercial buildings on the Mace soil need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil. On the Mace soil, the soft bedrock generally can be easily excavated for construction of dwellings with basements or buildings that have deep foundations. On the Mace soil, roads and streets need to be designed so that the surface pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance. On the Alliance soil, damage to roads and streets caused by frost action can be reduced by providing good surface drainage. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

These soils are assigned to capability units IIc-1, dryland, and I-4, irrigated, and to the Silty range site. The Mace soil is in windbreak suitability group 6R, and the Alliance soil is in windbreak suitability group 3.

McB—Mace-Alliance silt loams, 1 to 3 percent slopes. This complex consists of moderately deep, well drained Mace soil and deep, well drained Alliance soil. The soils are very gently sloping and are on uplands. These soils are in areas so intricately mixed or so small that it was not practical to map them separately. The mapped areas range from 15 to 320 acres in size and consist of about 45 to 55 percent Mace soil and 25 to 30 percent Alliance soil.

Typically, the Mace soil has a surface layer of grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is grayish brown, friable clay loam; the middle part is dark grayish brown, friable silty clay loam; and the lower part is light brownish gray, very friable silt loam. The underlying material, to a depth of 28 inches, is light gray, calcareous silt loam. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In some areas, the subsoil has more sand.

Typically, the Alliance soil has a surface layer of grayish brown, very friable silt loam about 8 inches thick. The subsoil is about 12 inches thick. The upper part is grayish brown, friable silty clay loam, and the lower part is pale brown, very friable silt loam. The underlying material is very pale brown very fine sandy loam to a depth of 50 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is very fine sandy loam.

Included with these soils in mapping are small areas of Canyon and Rosebud soils. Canyon soils are well drained and shallow and are on rounded knolls higher on the landscape. Rosebud soils are well drained and moderately deep, are higher on the landscape, and have a coarser subsoil than that of the Mace or Alliance soil. The included soils make up 15 to 25 percent of the mapped areas.

Permeability is moderately slow. The available water capacity is moderate in the Mace soil and high in the Alliance soil. The water intake rate is moderately low.

The content of organic matter is moderate. Weakly cemented caliche restricts root development in the Mace soil at a depth of 28 inches.

Most of the acreage is farmed. Under dryland management, the soils are suited to wheat. Introduced grasses can be grown for hay and pasture. The major hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. Inadequate rainfall during the growing season is a limitation. If the slopes are long and smooth enough, terracing and farming on the contour help prevent water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, the soils are suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses. The main hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase infiltration of water.

These soils are suited to adapted trees and shrubs in windbreaks. The survival rate of tree seedlings is good; the growth rate is moderate. Drought, competition for moisture from weeds and grasses, and soil blowing are the major hazards. Irrigation can supply moisture in periods of low rainfall. Herbicides can help control undesirable grasses and weeds in the tree rows. Weeds in the row or near small trees can be eliminated by hand hoeing or rototilling. A cover crop between rows can reduce soil blowing.

The Alliance soil generally is suited to use as sites for houses and small commercial buildings, but onsite investigation is needed. Building up or mounding the septic tank absorption field site with suitable fill material increases the filtering capacity of the field. The moderately slow permeability of the Alliance soil is a limitation for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the field. Sewage lagoons can be constructed in areas of this complex if the bottom of the lagoon is sealed after excavation to prevent seepage. Grading is required to modify the slope and shape the lagoon. The walls or sides of shallow excavations on the Alliance soil can be temporarily shored to prevent sloughing or caving. Foundations for houses and small commercial buildings on the Mace soil need to be strengthened and backfilled with coarse material to prevent damage caused by the shrinking and swelling of the soil. On the Mace soil, the soft bedrock generally can be easily excavated for construction of houses with basements or buildings that have deep foundations. On the Mace soil, roads and streets need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance. On the Alliance soil, good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

These soils are assigned to capability units IIe-1, dryland, and IIe-4, irrigated, and to the Silty range site. The Mace soil is in windbreak suitability group 6R, and the Alliance soil is in windbreak suitability group 3.

Mm—McCash very fine sandy loam, 0 to 1 percent slopes. This is a deep, nearly level, and well drained soil in swales on uplands. The areas commonly are long and narrow and range from 5 to 150 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam about 5 inches thick. The subsurface layer is grayish brown, very friable very fine sandy loam about 11 inches thick. The subsoil is grayish brown, very friable and friable very fine sandy loam about 30 inches thick. The underlying material to a depth of more than 60 inches is pale brown very fine sandy loam. In some areas, the surface layer is lighter in color. Also, in places, the subsoil has more clay.

Included with this soil in mapping are small areas of Ascalon, Goshen, Kuma, Satanta, and Woodly soils. Ascalon and Satanta soils have more fine sand and clay than the McCash soil, and the dark color of the surface layer does not extend below a depth of 20 inches. These soils are in slightly higher positions on the landscape than the McCash soil. Goshen and Kuma soils have more silt and clay and less very fine sand. They are in positions on the landscape similar to those of the McCash soil. Woodly soils have more fine sand and clay and are on similar landscapes. The included soils make up less than 10 percent of the map unit.

Permeability is moderate. The available water capacity is high. The content of organic matter is moderately low. The irrigation water intake rate is moderate. Runoff is slow. The soil is easily tilled within a wide range of moisture content.

This soil is used mainly for crops. In a few areas, it is irrigated. Some of the acreage is in native or reseeded grasses. The grasses are used for grazing or are mowed for hay.

Under dryland management, this soil is suited to wheat, introduced grasses, and alfalfa. The main limitation is a shortage of rainfall during the growing season. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods

that keep all or part of the crop residue on the surface help prevent soil blowing and also conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase infiltration of water. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, this soil is suited to corn, alfalfa, and introduced grasses. Corn is the main crop. Gravity irrigation systems may not be practical because the surrounding soils are undulating and have a moderately high water intake rate. Soil blowing is the major hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and also conserve soil moisture. Returning crop residue to the soil helps maintain or improve fertility and the content of organic matter. Efficient management of irrigation water is a concern.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to trees and shrubs in all types of windbreaks. Competition for moisture from grasses and weeds is the major hazard to the establishment of seedlings. Cultivating between tree rows and using selective herbicides around young trees help to conserve moisture.

This soil generally is suited to use as a site for houses and small commercial buildings. The moderate permeability of this soil is a limitation for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the absorption field. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIc-1, dryland, and I-6, irrigated, to the Silty range site, and to windbreak suitability group 1.

Mo—McCook silt loam, 0 to 2 percent slopes. This is a deep, nearly level to very gently sloping and well drained soil on bottom lands and low stream terraces. It is rarely flooded. The areas range from 20 to 80 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 10 inches thick. Below that, there is a transition layer of light brownish gray, very friable silt loam about 8 inches thick. The underlying material is pale brown, finely stratified silt loam in the upper part, light brownish gray silt loam in the middle part, and light brownish gray very fine sandy loam in the lower part to a depth of more than 60 inches. In some areas, the surface layer is less than 8 inches thick. In places, the underlying material is fine sandy loam.

Included with this soil in mapping are small areas of Bridget soils, which are on the same type of landscape. Unlike the McCook soil, Bridget soils are not stratified. These soils make up 5 to 10 percent of the map unit.

Permeability is moderate. Runoff is slow. The available water capacity is high. The content of organic matter is moderate, generally from 2 to 4 percent. The irrigation water intake rate is moderate. Tilth is good.

This soil is used mainly for crops. In most areas, it is irrigated.

Under dryland management, this soil is suited to wheat, alfalfa, and introduced grasses. The main limitation is a shortage of rainfall during the growing season. Soil blowing and water erosion are hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase infiltration of water. Commercial fertilizers are used to build up the fertility of the soil.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and also conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to trees and shrubs in all types of windbreaks and shelterbelts. The major concerns are insufficient rainfall and competition for moisture from weeds and grasses. Irrigation can supply moisture in periods of low rainfall. Cultivation between the rows of trees and shrubs with conventional equipment and the use of appropriate herbicides in the row help control undesirable grasses and weeds.

The hazard of flooding needs to be considered if this soil is used for sanitary facilities and as building sites. The moderate permeability of this soil is a limitation for septic tank absorption fields, but this limitation generally can be overcome by increasing the size of the field. Sewage lagoons need to be diked for protection against flooding. Houses and buildings can be constructed on elevated, well compacted fill material as protection against flooding. Constructing roads on suitable, well compacted fill material and providing adequate side

ditches and culverts help protect roads from flood damage. Good surface drainage can reduce damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIc-1, dryland, and I-6, irrigated, to the Silty Lowland range site, and to windbreak suitability group 1L.

Mp—McCook silt loam, occasionally flooded, 0 to 2 percent slopes. This is a deep, nearly level to very gently sloping and moderately well drained soil on bottom lands and low stream terraces. This soil is occasionally flooded. The areas range from 20 to 640 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 15 inches thick. Below that, there is a transition layer of grayish brown, very friable silt loam about 9 inches thick. The underlying material is light brownish gray silt loam in the upper part and light brownish gray, coarsely stratified silt loam in the lower part to a depth of more than 60 inches. In some areas the color of the surface layer extends to a depth of less than 8 inches. Also, in places the underlying material is fine sandy loam.

Included with this soil in mapping are small areas of the somewhat poorly drained Gibbon and Wann soils in slightly lower positions. Also, in places the transition layer has more clay. The included soils make up 2 to 12 percent of the map unit.

Permeability is moderate. Runoff is slow. The available water capacity is high. The content of organic matter is moderate, generally between 2 and 4 percent. The irrigation water intake rate is moderate. Tilth is good.

This soil is used mainly for crops. In most areas, it is irrigated.

Under dryland management, this soil is suited to wheat and alfalfa. Introduced grasses can be grown for hay or pasture. The major hazards are occasional flooding after heavy rains and soil blowing if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses. Occasional flooding after heavy rains is a hazard. Soil blowing is also a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to trees and shrubs in windbreaks. The rate of survival is good. Competition for moisture from weeds and grasses is the major hazard. Weeds and grasses can be controlled by cultivation with conventional equipment between the tree rows. Hand hoeing, rototilling, and appropriate herbicides can be used in the tree rows.

This soil is not suited to septic tank absorption fields and to use as a site for houses and small commercial buildings because of flooding. Sewage lagoons need to be diked for protection against flooding. Constructing roads on suitable, well compacted fill material above flood level and providing adequate side ditches and culverts help protect roads from flood damage.

This soil is assigned to capability units IIw-3, dryland, and IIw-6, irrigated, to the Silty Lowland range site, and to windbreak suitability group 1L.

MtB—McCook silt loam, channeled, 0 to 3 percent slopes. This is a deep, nearly level and very gently sloping, moderately well drained soil on a flood plain. It is subject to frequent flooding. This soil is in a single long, narrow area, which is dissected by channels that meander back and forth across the flood plain. The channels are 30 to 80 feet wide and 5 to 20 feet deep. Slopes are mainly less than 3 percent but are as much as 6 percent on some narrow benches, on streambanks, and in some deep gullies. The area is 270 acres in size.

Typically, the surface layer is stratified, light brownish gray and grayish brown, very friable silt loam about 10 inches thick. Below that, there is a transition layer of stratified, light brownish gray and grayish brown, very friable silt loam about 8 inches thick. The underlying material is stratified, pale brown very fine sandy loam in the upper part and stratified, light gray silt loam in the lower part to a depth of more than 60 inches. This soil contains lime throughout. In some areas, the surface layer is not stratified. Also, in places the underlying material is fine sandy loam.

Included with this soil in mapping are small areas of Gibbon and Wann soils. These soils are somewhat poorly drained and are in slightly lower positions. The included soils make up 3 to 10 percent of the map unit.

Permeability is moderate. The available water capacity is high. Runoff is slow. The content of organic matter is moderately low.

This soil is mainly in native grasses, and trees are numerous in many places. In most areas, the grasses are used for grazing.

This soil is not suited to cultivation because of occasional overflow, streambank cutting, and channel changes.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing and deposition of silt reduce the protective cover and cause deterioration of the native plants. Proper grazing use, timely deferment of grazing, and a

system of use and rest that varies from year to year help to maintain or improve the range condition.

The areas that are covered with trees and shrubs provide good cover and habitat for many kinds of wildlife.

This soil is not suited to windbreak plantings because of streambank cutting and shifting channels. In some areas, it can be used for wildlife habitat or forestation plantings if the trees and shrubs are planted by hand.

This soil is not suited to building sites, septic tanks, or sewage lagoons because of flooding. Constructing roads on suitable, well compacted fill material above flood level and providing adequate side ditches and culverts help protect roads from flood damage.

This soil is assigned to capability unit VIw-7, to the Silty Overflow range site, and to windbreak suitability group 10.

OaF—Otero-Canyon loams, 6 to 20 percent slopes. This complex consists of deep Otero soil and shallow Canyon soil. Both soils are well drained and are strongly sloping and steep. They are near natural drainageways on uplands. The Otero soil is on the lower part of colluvial side slopes adjacent to the natural drainageways. The Canyon soil is on the upper part of side slopes and on ridgetops between side slopes. Many small drainageways dissect the side slopes. A few pieces of bedrock material are on the surface in areas of the Canyon soil. The areas of these soils are so intricately mixed or so small that it was not practical to map them separately. This complex consists of about 60 to 79 percent Otero soil and 19 to 26 percent Canyon soil. The mapped areas range from 20 to 2,000 acres in size.

Typically, the Otero soil has a surface layer of grayish brown, very friable loam about 5 inches thick. Below that, there is a transition layer of light brownish gray, very friable very fine sandy loam about 7 inches thick. The underlying material is very pale brown very fine sandy loam to a depth of more than 60 inches. In a few small areas, the surface layer is very fine sandy loam, fine sandy loam, or silt loam.

Typically, the Canyon soil has a surface layer of grayish brown, very friable loam about 4 inches thick. Below that, there is a transition layer of light brownish gray, very friable loam about 6 inches thick. The underlying material is light gray loam to a depth of 17 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is very fine sandy loam, fine sandy loam, or silt loam.

Included in mapping are small areas of alluvial material and Colby soils. The alluvial material is recently deposited along the natural drainageways. Colby soils are finer textured than the Otero and Canyon soils and are at a higher elevation on the landscape. The included areas make up less than 15 percent of the mapped areas.

Permeability is moderately rapid in the Otero soil and moderate in the Canyon soil. The available water capacity is high in the Otero soil and low in the Canyon soil. In both soils, the content of organic matter is low. Runoff is rapid.

Most of the acreage is in native grasses, which are used for grazing. These soils are not suited to farming because of the steepness of slopes, the susceptibility to water erosion, and the shallowness of the Canyon soil.

These soils are suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Proper grazing use, timely deferment of grazing, and a system of use and rest that varies from year to year help maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded cropland.

These soils are not suited to trees and shrubs in windbreaks because of the steepness of slopes and because of the shallowness and the low available water capacity of the Canyon soil. In areas of the Otero soil, trees and shrubs can be planted for wildlife habitat or for recreation uses. Onsite investigation is needed.

Onsite investigation is needed in areas of these soils before any engineering practices are started. On the Otero soil, land shaping and installing septic tank absorption fields on the contour are generally necessary for proper operation of the field. The Canyon soil generally is not suited to septic tank absorption fields and sewage lagoons because of shallowness to bedrock. Sewage lagoons on the Otero soil need to be lined or sealed to prevent seepage, and extensive grading is required to modify the slope. On the Otero soil, houses and small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. On the Canyon soil the soft bedrock generally can be easily excavated for construction of houses with basements or buildings that have deep foundations. Also, cuts and fills generally are needed to provide a suitable grade for roads and streets. On the Canyon soil the soft bedrock needs to be excavated in constructing roads and streets.

The soils in this complex are assigned to capability unit VIe-1. The Otero soil is in Limy Upland range site, and the Canyon soil is in Shallow Limy range site. Both soils are in windbreak suitability group 10.

OaG—Otero-Canyon loams, 20 to 45 percent slopes. This complex consists of deep, well drained Otero soil and shallow, well drained Canyon soil. Both soils are steep and very steep and are in deeply dissected canyon and bluff areas on uplands (fig. 9). The Otero soil is on lower colluvial side slopes adjacent to the very narrow natural drainageways at the bottom of the canyons. The Canyon soil is on ridgetops and on the upper part of side slopes. A few rock ledges outcrop on

Figure 9.—Landscape of Otero-Canyon loams, 20 to 45 percent slopes. The Otero soil is on the lower side slopes below the Canyon soil, which has numerous rock outcrops. Gannett, Wann, and Gibbon soils are on the partly wooded bottom lands at right center.

the shoulders of side slopes and on ridgetops. Many small natural drainageways dissect the side slopes. The areas of these soils are so intricately mixed or so small that it was not possible to map them separately. The mapped areas are about 45 to 62 percent Otero soil and 27 to 46 percent Canyon soil and range from 40 to 4,000 acres in size.

Typically, the Otero soil has a surface layer of dark grayish brown, very friable loam about 7 inches thick. Below that, there is a transition layer of light brownish gray, very friable very fine sandy loam about 9 inches thick. The underlying material is very pale brown very fine sandy loam to a depth of more than 60 inches. In a few small areas, the surface layer is very fine sandy loam, fine sandy loam, or silt loam.

Typically, the Canyon soil has a surface layer of grayish brown, very friable loam about 4 inches thick. Below that, there is a transition layer of light brownish gray, very friable loam about 4 inches thick. The underlying material is light gray loam to a depth of 12 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is very fine sandy loam, fine sandy loam, or silt loam.

Included with these soils in mapping are small areas of alluvial material, Colby soils, and rock outcrops. The alluvial material is recently deposited along the narrow natural drainageways at the bottom of the canyons. Colby soils are at a higher elevation on the landscape and are finer textured than the Otero and Canyon soils. The rock outcrops are on ridgetops and upper side slopes in areas of the Canyon soil. They consist of

carbonate-cemented earth material, limestone, fine-grained sandstone, and caliche. The included areas make up 10 to 20 percent of the mapped areas.

Permeability is moderately rapid in the Otero soil and moderate in the Canyon soil. The available water capacity is high in the Otero soil and low in the Canyon soil. In both soils, the content of organic matter is low. Runoff is rapid.

Almost all the acreage is in native grasses, which are used for grazing. These soils are not suited to crops because of the steep and very steep slopes.

These soils are suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing reduces the protective cover and causes deterioration of the native plants. Overgrazing also can result in severe soil losses from water erosion. Proper grazing use, timely deferment of grazing, and a system of use and rest that varies from year to year help maintain or improve the range condition.

These soils are not suited to trees and shrubs in windbreaks because the slopes are too steep and uneven for trees to survive and grow well.

Onsite investigation is needed before any engineering practices are started. These soils generally are not suited to sanitary facilities because of the steep and very steep slopes and because of the shallowness to bedrock of the Canyon soil. The soft bedrock under the Canyon soil generally can be easily excavated for construction of houses with basements or buildings that have deep foundations. Houses and small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. Cutting and filling generally are needed to provide a suitable grade for roads and streets.

These soils are assigned to capability unit VIIs-4. Otero soil is in Limy Upland range site, and Canyon soil is in Shallow Limy range site. Both soils are in windbreak suitability group 10.

Rs—Rosebud loam, 0 to 1 percent slopes. This is a moderately deep, nearly level, well drained soil on uplands. The areas of this soil range from 15 to 500 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 5 inches thick. The subsoil is about 15 inches thick. The upper part is brown, firm clay loam, and the lower part is light brownish gray, friable, calcareous sandy clay loam. The underlying material is pale brown, calcareous loam to a depth of 34 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few areas, the surface layer is fine sandy loam. In a few small areas, land leveling has removed the dark surface layer. In a few areas, the subsoil has less sand.

Included with this soil in mapping are small areas of Alliance, Ascalon, and Canyon soils. Alliance soils are deep, are finer textured than the Rosebud soil, and are in similar positions on the landscape. Ascalon soils are deep and are slightly higher on the landscape than the Rosebud soil. Canyon soils are shallow and are on rounded knolls higher on the landscape than the Rosebud soil. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderate. The available water capacity is moderate. The irrigation water intake rate is moderate, and runoff is slow. The content of organic matter is moderate. The surface layer is easily tilled within a wide range of moisture content. This soil releases moisture readily to plants.

Most of the acreage of this soil is farmed. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for hay or pasture. Insufficient rainfall during the growing season is the main limitation. Soil blowing is a serious hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses for hay or pasture (fig. 10). Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve soil moisture. Efficient management of irrigation water is a concern. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to adapted trees and shrubs in windbreaks. The major limitations and hazards are drought, competition from weeds and grasses, the moderate available water capacity, and soil blowing. Irrigation can supply moisture in periods of insufficient rainfall. Cultivation between the tree rows with conventional equipment can control undesirable grasses and weeds. Appropriate herbicides or hand methods, such as hoeing, can control weeds in the row. A cover crop can reduce soil blowing.

This soil generally is suited to use as a site for houses without basements and small commercial buildings. Building up or mounding the septic tank absorption field site with suitable fill material increases the filtering capacity of the field. Sewage lagoons can be constructed on this soil if the bottom of the lagoon is sealed after excavation to prevent seepage. The soft bedrock generally can be easily excavated for construction of houses with basements or buildings that have deep foundations. Good surface drainage can reduce damage to roads and streets caused by frost

Figure 10.—This field of sugar beets on Rosebud loam, 0 to 1 percent slopes, is irrigated by a gravity system.

action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIc-1, dryland, and I-7, irrigated, to the Silty range site, and to windbreak suitability group 6R.

RsB—Rosebud loam, 1 to 3 percent slopes. This is a moderately deep, very gently sloping, well drained soil on ridges and undulating mounds on uplands. The areas of this soil range from 15 to 150 acres in size.

Typically, the surface layer is grayish brown, very friable loam about 5 inches thick. The subsoil is about 14 inches thick. The upper part is brown, firm clay loam, and the lower part is pale brown, friable, calcareous sandy clay loam. The underlying material is very pale brown sandy loam to a depth of 31 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is fine sandy loam. In other small areas, the surface layer has been removed by land leveling. In a few areas, the subsoil has less sand.

Included with this soil in mapping are small areas of Alliance and Canyon soils. The Alliance soils are deep and silty and are at a slightly lower elevation than the Rosebud soil. The Canyon soils are shallow and are on

slightly rounded knolls above the Rosebud soil. The included soils make up 8 to 15 percent of the map unit.

Permeability is moderate. The available water capacity is moderate. Runoff is medium, and the water intake rate is moderate. The content of organic matter is moderate.

Most of the acreage of this soil is farmed. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for hay or pasture. The major hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. Insufficient rainfall during the growing season and the moderately deep root zone are limitations. Terracing and stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses. The main hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help reduce water erosion and soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to adapted trees and shrubs in farmstead, livestock, and field windbreaks. The limitations and hazards are drought, slope and excessive runoff, competition for moisture from weeds and undesirable grasses, the moderate available water capacity, and soil blowing. Irrigation can supply moisture in periods of insufficient rainfall. Planting trees on the contour in combination with terraces allows cultivation between the tree rows to conserve moisture and control weeds. A cover crop between the rows reduces soil blowing.

This soil generally is suited to use as a site for houses without basements and for small commercial buildings. Building up or mounding the septic tank absorption field site with suitable fill material increases the filtering capacity of the field. Sewage lagoons can be constructed on this soil if the bottom of the lagoon is sealed after excavation to prevent seepage. The soft bedrock generally can be easily excavated for construction of houses with basements or buildings that have deep foundations. Good surface drainage reduces damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-7, irrigated, to the Silty range site, and to windbreak suitability group 6R.

Rt—Rosebud-Canyon loams, leveled, 0 to 1 percent slopes. This complex consists of moderately deep Rosebud soil and shallow Canyon soil. Both soils are well drained, are nearly level, and are on uplands. The areas of this complex at one time were slightly hummocky; the Rosebud soil was between hummocks, and the Canyon soil was on the hummocks. The soils have been leveled by cutting and filling. The areas of these soils are so intricately mixed or so small that it was not practical to map them separately. The mapped areas range from 20 to 800 acres in size and consist of about 50 to 60 percent Rosebud soil and 25 to 30 percent Canyon soil.

Typically, the Rosebud soil has a surface layer of grayish brown, very friable loam about 6 inches thick. The subsoil is about 13 inches thick. The upper part is brown, firm clay loam, and the lower part is pale brown, friable, calcareous sandy clay loam. The underlying material is very pale brown, calcareous fine sandy loam to a depth of 32 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer and part of the subsoil have been removed by land leveling. In a few areas, the subsoil has less sand than is typical.

Typically, the Canyon soil has a surface layer of grayish brown, very friable, calcareous loam about 3 inches thick. Below that, there is a transition layer of light brownish gray, very friable, calcareous fine sandy loam about 3 inches thick. The underlying material is very pale brown, calcareous very fine sandy loam to a depth of 10 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer and transition layer have been removed by leveling.

Included in mapping are small areas of a moderately deep soil that has a coarser subsoil than that of the Rosebud soil. This soil makes up less than 15 percent of the mapped areas.

Rosebud and Canyon soils are moderately permeable. The available water capacity is moderate in the Rosebud soil and low in the Canyon soil. The content of organic matter is moderate in the Rosebud soil and low in the Canyon soil.

Almost all the acreage of this complex is in gravity-irrigated crops (fig. 11). Under irrigation, these soils are suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. The low moisture supply is a limitation. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help to prevent soil blowing and to conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

The Rosebud soil is suited to adapted trees and

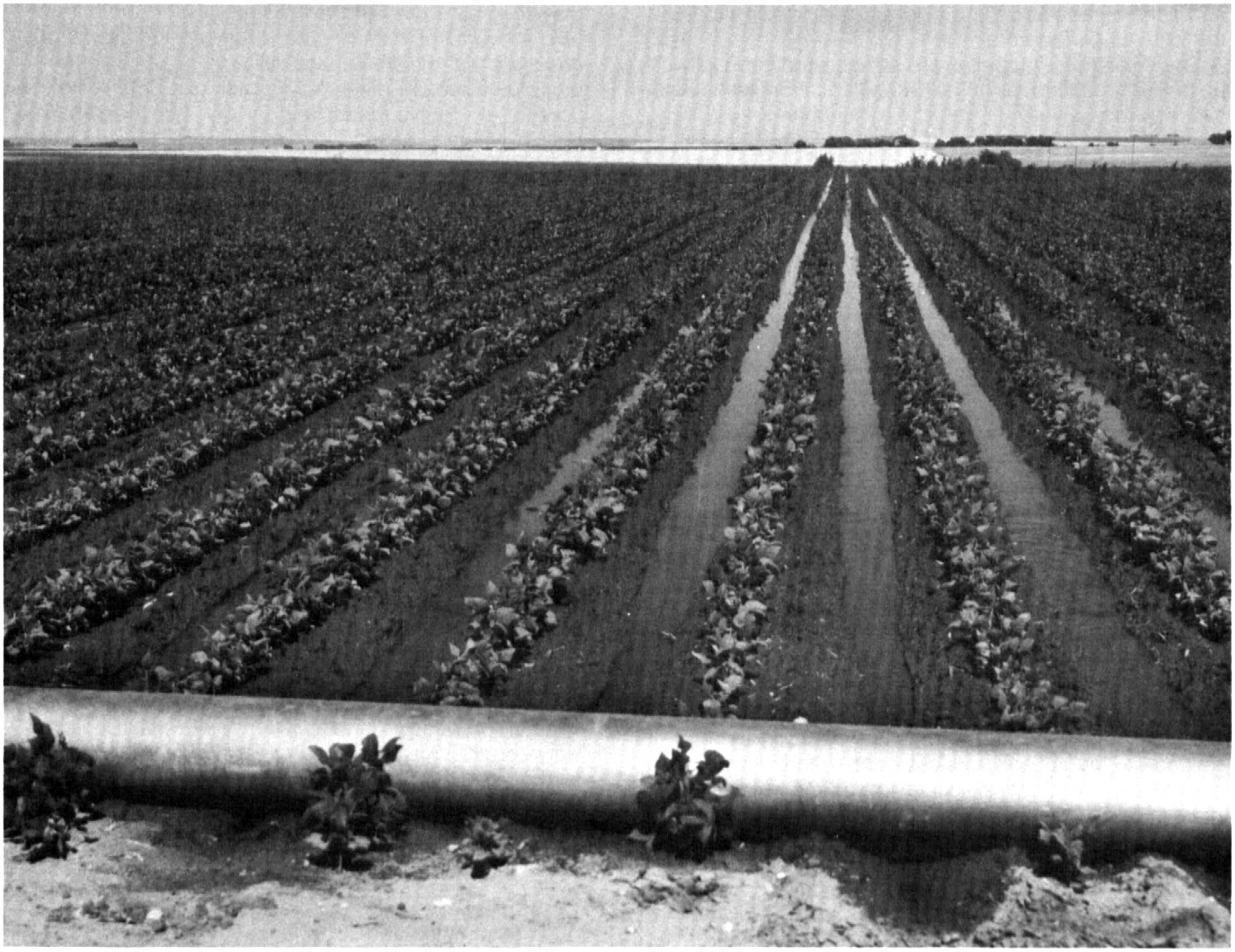

Figure 11.—Pinto beans in an area of Rosebud-Canyon loams, leveled, 0 to 1 percent slopes. The field is irrigated by a gravity system that uses gated pipe.

shrubs in windbreaks. The Canyon soil is not suited because it is too shallow and limy for trees to survive and grow well. Onsite investigation is needed to plan a windbreak in areas of this complex. The main limitations and hazards on the Rosebud soil are drought, competition from weeds and undesirable grasses, the moderate available water capacity, and soil blowing. Irrigation can supply moisture during periods of insufficient rainfall. Cultivation between the tree rows and herbicides can control undesirable grasses and weeds. A cover crop reduces soil blowing.

The Rosebud soil generally is suited to use as a site for houses without basements and for small commercial buildings. Onsite investigation, however, is needed. The Canyon soil generally is not suited to septic tank absorption fields and sewage lagoons because of its shallowness to bedrock. On the Rosebud soil, building up or mounding the septic tank absorption field site with suitable fill material increases the filtering capacity of the field. Sewage lagoons can be constructed in areas of the Rosebud soil if the bottom of the lagoon is sealed to prevent seepage. The soft bedrock generally can be easily excavated in constructing houses with basements or buildings that have deep foundations. On the Canyon soil, the soft bedrock generally can be easily excavated in building roads and streets. On the Rosebud soil, good surface drainage reduces damage to roads and streets caused by frost action. Crowning the road by grading

and constructing adequate side ditches help to provide the needed surface drainage.

The soils in this complex are assigned to capability units IIIs-1, dryland, and IIIs-7, irrigated. The Rosebud soil is in the Silty range site and in windbreak suitability group 6R. The Canyon soil is in the Shallow Limy range site and in windbreak suitability group 10.

RtB—Rosebud-Canyon loams, 0 to 3 percent slopes. This complex consists of moderately deep Rosebud soil and shallow Canyon soil. The soils are well drained and very gently sloping. They are on slightly hummocky uplands. The Rosebud soil is between hummocks, and the Canyon soil is on the hummocks. The areas of these soils are so intricately mixed or so small that it was not practical to map them separately. The mapped areas range in size from 15 to 1,800 acres and consist of about 50 to 60 percent Rosebud soil and about 20 to 30 percent Canyon soil.

Typically, the Rosebud soil has a surface layer of grayish brown, very friable loam about 6 inches thick. The subsoil is about 14 inches thick. The upper part is grayish brown, firm clay loam, and the lower part is light brownish gray, friable, calcareous sandy clay loam. The underlying material is pale brown, calcareous loam in the upper part and very pale brown, calcareous very fine sandy loam in the lower part to a depth of 30 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is fine sandy loam. In a few areas, the subsoil has less sand than is typical.

Typically, the Canyon soil has a surface layer of dark grayish brown, very friable, calcareous loam about 6 inches thick. Below that, there is a transition layer of light brownish gray, very friable, calcareous loam about 5 inches thick. The underlying material is light gray, calcareous loam to a depth of 14 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches.

Included in mapping are small areas of a moderately deep soil that has a coarser subsoil than that of the Rosebud soil. This soil is on about the same kind of landscape as Rosebud and Canyon soils and makes up less than 15 percent of the mapped areas.

Rosebud and Canyon soils are moderately permeable. The available water capacity is moderate in the Rosebud soil and low in the Canyon soil. The content of organic matter is moderate in the Rosebud soil and low in the Canyon soil.

Most of the acreage is farmed. Under dryland management, the soils are suited to wheat. Introduced grasses can be grown for hay or pasture. The major limitations are the moderate and low moisture supply and the shallow to moderately deep root zone. Soil blowing and water erosion are hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, these soils are suited to corn, sugar beets, pinto beans, alfalfa, and introduced grasses for hay or pasture. The major limitation is the shallow to moderately deep root zone. Soil blowing and water erosion are hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility and also help increase the infiltration of water.

The Rosebud soil is suited to adapted trees and shrubs in windbreaks. The Canyon soil is not suited to trees and shrubs in windbreaks because the soil is too shallow and limy for trees to survive and grow. Onsite investigation is needed to properly plan a windbreak in areas of these soils. The major limitations and hazards on the Rosebud soil are drought, competition from weeds and undesirable grasses, the moderate available water capacity, and soil blowing. Irrigation can supply moisture in periods of insufficient rainfall. Cultivation between tree rows and appropriate herbicides in the tree rows can control undesirable grasses and weeds. A cover crop reduces soil blowing.

The Rosebud soil generally is suited to use as a site for houses without basements and for small commercial buildings. Onsite investigation, however, is needed. The Canyon soil generally is not suited to septic tank absorption fields and sewage lagoons because of its shallowness to bedrock. On the Rosebud soil, building up or mounding the septic tank absorption field site with suitable fill material increases the filtering capacity of the soil. Sewage lagoons can be constructed on the Rosebud soil if they are sealed to prevent seepage. The soft bedrock generally can be easily excavated in the construction of buildings that have basements or deep foundations. On the Canyon soil, the soft bedrock generally can be easily excavated in building roads and streets. On the Rosebud soil, good surface drainage reduces damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

The soils in this complex are assigned to capability units IIIs-1, dryland, and IIIs-7, irrigated. The Rosebud soil is in the Silty range site and in windbreak suitability group 6R. The Canyon soil is in the Shallow Limy range site and in windbreak suitability group 10.

RtC—Rosebud-Canyon loams, 3 to 6 percent slopes. This complex consists of moderately deep Rosebud soil and shallow Canyon soil. The soils are well drained and are gently sloping. They are on slightly hummocky side slopes of natural drainageways on the uplands. The Rosebud soil is between hummocks, and the Canyon soil is on the hummocks. The areas of these soils are so intricately mixed or so small that it was not practical to map them separately. The mapped areas consist of about 50 to 60 percent Rosebud soil and about 25 to 35 percent Canyon soil and range from 10 to 400 acres in size.

Typically, the Rosebud soil has a surface layer of grayish brown, very friable loam about 5 inches thick. The subsoil is about 13 inches thick. The upper part is brown, firm clay loam, and the lower part is pale brown, friable, calcareous sandy clay loam. The underlying material is very pale brown, calcareous fine sandy loam in the upper part and very pale brown, calcareous sandy loam in the lower part to a depth of 29 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is fine sandy loam.

Typically, the Canyon soil has a surface layer of grayish brown, very friable, calcareous loam about 5 inches thick. Below that, there is a transition layer of light brownish gray, very friable, calcareous loam about 5 inches thick. The underlying material is light gray, calcareous loam to a depth of 14 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is fine sandy loam.

Included in mapping are small areas of moderately deep soils that have a coarser subsoil than that of the Rosebud soil and are on about the same kind of landscape as Rosebud and Canyon soils. These included soils make up less than 10 percent of the mapped areas.

Rosebud and Canyon soils are moderately permeable. The available water capacity is moderate in the Rosebud soil and low in the Canyon soil. The content of organic matter is moderate in the Rosebud soil and low in the Canyon soil.

Most of the acreage is farmed, but in a few areas, the soils are in native grasses, which are used for grazing or mowed for hay. Under dryland management, the soils are poorly suited to wheat. Introduced grasses can be grown for hay or pasture. The major hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. Insufficient rainfall during the growing season and the shallow to moderately deep root zone are limitations. Terraces and farming on the contour help reduce serious water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help reduce water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, these soils are suited to corn, alfalfa, and introduced grasses. The main hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. The shallow to moderately deep root zone is a limitation. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

These soils are suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can result in severe soil losses from water erosion. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

The Rosebud soil is suited to trees in windbreaks. The Canyon soil is not suited to trees in windbreaks because it is too shallow and limy for trees to survive and grow. Onsite investigation is needed to properly plan a windbreak in areas of these soils. The main limitations and hazards on the Rosebud soil are drought, slope and excessive runoff, competition from weeds and undesirable grasses, the moderate available water capacity, and soil blowing. Irrigation can supply moisture in periods of insufficient rainfall. Planting trees on the contour in combination with terraces allows normal cultivation between the tree rows, which helps store moisture and control weeds. A cover crop reduces soil blowing.

The Rosebud soil generally is suited to use as a site for houses without basements. Onsite investigation is needed. The Canyon soil generally is not suited to septic tank absorption fields and sewage lagoons because of its shallowness to bedrock. On the Rosebud soil, raising or mounding the septic tank absorption field site with suitable fill material increases the filtering capacity of the field. Sewage lagoons can be constructed on the Rosebud soil if they are lined or sealed to prevent seepage. The soft bedrock generally can be easily excavated in constructing houses with basements or buildings that have deep foundations. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. On the Canyon soil, the soft bedrock generally can be easily excavated for roads and streets. On the Rosebud soil, good surface drainage reduces damage to roads and streets caused by frost action. Crowning the

road by grading and constructing adequate side ditches help to provide the needed surface drainage.

These soils are assigned to capability units IVe-1, dryland, and IVe-7, irrigated. The Rosebud soil is in the Silty range site and in windbreak suitability group 6R. The Canyon soil is in the Shallow Limy range site and in windbreak suitability group 10.

RtD2—Rosebud-Canyon loams, 6 to 11 percent slopes, eroded. This complex consists of moderately deep Rosebud soil and shallow Canyon soil. These soils are well drained and are strongly sloping. They are on upland ridgetops and side slopes of natural drainageways. Numerous small rills and gullies 3 to 12 inches deep dissect the slopes. In many places, part or all of the original surface soil has been removed by erosion. In a few places, the underlying weakly cemented caliche is exposed at the surface. The areas of these soils are so intricately mixed or so small that it was not practical to map them separately. The mapped areas of this complex are about 40 to 55 percent Rosebud soil and 25 to 40 percent Canyon soil, and they range in size from 15 to 600 acres.

Typically, the Rosebud soil has a surface layer of grayish brown, very friable loam about 4 inches thick. The subsoil is about 9 inches thick. The upper part is grayish brown, friable clay loam, and the lower part is light brownish gray, friable loam. The underlying material is light gray, calcareous sandy loam to a depth of 21 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few areas, the surface layer is fine sandy loam.

Typically, the Canyon soil has a surface layer of light brownish gray, very friable, calcareous loam about 5 inches thick. Below that, there is a transition layer of light brownish gray, very friable, calcareous loam about 4 inches thick. The underlying material is light gray, calcareous loam to a depth of 15 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is fine sandy loam, very fine sandy loam, or loamy fine sand.

Included in mapping are small areas of moderately deep soils that have a coarser textured subsoil than that of the Rosebud soil. The soils are on landscapes similar to those of the Rosebud and Canyon soils. These included soils make up less than 10 percent of the mapped areas.

Rosebud and Canyon soils have moderate permeability and a moderate water intake rate. The available water capacity is moderate in the Rosebud soil and low in the Canyon soil. The content of organic matter is moderate in the Rosebud soil and low in the Canyon soil.

Almost all the acreage is farmed. In a few areas the soils have been reseeded to native grasses, which are used for grazing or mowed for hay. Under dryland management, these soils are poorly suited to wheat. Introduced grasses can be grown for hay or pasture. The major hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. The main limitations are the low moisture supply and the moderately deep to shallow rooting zone. If the slopes are long enough, terracing these soils and farming them on the contour help prevent serious water erosion. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help reduce water erosion and soil blowing and also conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and soil tilth and also increase infiltration of water. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, these soils are poorly suited to corn, alfalfa, and introduced grasses. The main hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing and also conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the organic matter content and fertility.

These soils are suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can result in severe soil losses from water erosion. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

The Rosebud soil is suited to trees and shrubs in windbreaks. The Canyon soil generally is not suited to trees and shrubs in windbreaks because it is too shallow and limy for trees to survive and grow well. Nevertheless, the soils are so closely intermingled that areas of both soils generally need to be managed as one area. The major limitations and hazards on the Rosebud soil are drought, slope and excessive runoff, competition from weeds and undesirable grasses, the moderate available water capacity, and soil blowing. Irrigation can supply moisture in periods of insufficient rainfall. Planting trees on the contour in combination with terraces allows normal cultivation between the tree rows, which helps store moisture and control weeds. Applying appropriate herbicides or hoeing by hand can control weeds and undesirable grasses. A cover crop reduces soil blowing.

Onsite investigation is needed before any engineering practices are started. On the Rosebud soil, raising or mounding a septic tank absorption field site with suitable fill material increases the filtering capacity of the field.

The Canyon soil generally is not suited to septic tank absorption fields and sewage lagoons because of its shallowness to bedrock. Sewage lagoons can be constructed on the Rosebud soil if they are sealed or lined to prevent seepage. Also, extensive grading is required to modify the slope and shape the lagoon. The soft bedrock generally can be easily excavated in the construction of houses with basements or buildings that have deep foundations. Houses and small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. On the Canyon soil, the soft bedrock generally can be easily excavated in constructing roads and streets. On the Rosebud soil, surface drainage reduces damage to roads and streets by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. Cuts and fills generally are needed to provide a suitable grade for roads and streets.

The soils in this complex are assigned to capability units IVe-1, dryland, and IVe-7, irrigated. Rosebud soil is in Silty range site and windbreak suitability group 6R. Canyon soil is in Shallow Limy range site and in windbreak suitability group 10.

SaC—Sarben loamy very fine sand, 3 to 6 percent slopes. This is a deep, gently sloping, well drained soil on ridges, side slopes, and undulating uplands. The areas of this soil range in size from 15 to 150 acres.

Typically, the surface layer is brown, very friable loamy very fine sand about 6 inches thick. Below that, there is a transition layer of pale brown, very friable loamy very fine sand about 11 inches thick. The underlying material is very pale brown loamy very fine sand to a depth of more than 60 inches. In some areas, the surface layer is very fine sandy loam. In places the surface layer is darker in color.

Included with this soil in mapping are small areas of Valent soils. Valent soils have more sand throughout and are on about the same kind of landscape as the Sarben soil. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderately rapid, and the available water capacity is moderate. The water intake rate is high, and runoff is slow. The content of organic matter is low. Tilth is good.

Most of the acreage is farmed. In some areas, the soil is in native or reseeded grasses, which are used for grazing or mowed for hay. Under dryland management, this soil is poorly suited to wheat and introduced grasses. Soil blowing and water erosion are hazards if the surface is not adequately protected by crops or crop residue. A shortage of rainfall during the growing season is a limitation. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and soil tilth and also increase infiltration of water. Summer fallow is used if wheat is grown.

If a sprinkler irrigation system is used, this soil is suited to corn, alfalfa, and introduced grasses. Soil blowing and water erosion are hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, discing, chiseling, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion as well as conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth. Efficient management of irrigation water is a concern.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing leaves the soil subject to soil blowing and small blowouts. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded cropland.

This soil is suited to trees and shrubs in all types of windbreaks and shelterbelts. Insufficient moisture, soil blowing, competition from grasses and weeds, and water erosion are the main concerns in establishing seedlings. Irrigation can supply moisture. Strips of sod or a cover crop between the tree rows control soil blowing. Competing grasses and weeds can be eliminated by cultivating, hoeing, or using herbicides. Trees can be planted on the contour to help prevent excessive erosion.

This soil generally is suited to use as septic tank absorption fields, sites for dwellings, and local roads and streets. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient.

This soil is assigned to capability units IVe-5, dryland, and IVe-10, irrigated, to the Sandy range site, and to windbreak suitability group 5.

SaD—Sarben loamy very fine sand, 6 to 9 percent slopes. This is a deep, strongly sloping, well drained soil on rolling uplands and side slopes. The areas of this soil range from 15 to 100 acres in size.

Typically, the surface layer is brown, very friable loamy very fine sand about 6 inches thick. Below that, there is a transition layer of pale brown, very friable loamy very fine sand about 6 inches thick. The underlying material is pale brown loamy very fine sand in the upper part and very pale brown loamy very fine sand in the lower part to

a depth of more than 60 inches. In some areas, the surface layer is loamy fine sand. In places, the surface layer is darker in color.

Included with this soil in mapping are small areas of Valent soils. Valent soils have more sand throughout than the Sarben soil and are on similar landscapes. These soils make up 5 to 10 percent of the map unit.

Permeability is moderately rapid, and the available water capacity is moderate. The content of organic matter is low. The water intake rate is high. Runoff is medium.

Most of the acreage of this soil is farmed. In some areas, this soil is in native grasses or introduced grasses. The grasses are used for grazing or are mowed for hay. This soil is not suited to dryland farming because of its moderately rapid permeability and susceptibility to soil blowing and water erosion.

Under sprinkler irrigation, this soil is poorly suited to corn, alfalfa, and introduced grasses. Water erosion and soil blowing are severe hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage practices that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion as well as conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth. Efficient management of irrigation water is a concern.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also leads to severe losses from soil blowing and small blowouts. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded cropland.

This soil provides a fair site for trees and shrubs in windbreaks and shelterbelts. The major hazards and limitations are loose surface soil, soil blowing and covering of seedlings by drifting sand in high winds, lack of moisture, competition from weeds and undesirable grasses, and water erosion on strongly sloping sites. Sod strips between the tree rows help stabilize the loose surface soil. Trees need to be planted in a shallow furrow with minimal disturbance of the soil to prevent soil blowing. Irrigation can supply water in periods of insufficient rainfall. Areas close to the trees can be hoed by hand, and sod strips between the rows help control weeds and undesirable grasses. Planting trees on the contour and maintaining strips of sod between the rows help control water erosion. Some strongly sloping sites can be planted by hand.

Land shaping and contouring generally are necessary for proper operation of septic tank absorption fields. Sewage lagoons need to be lined or sealed to prevent seepage, and extensive grading is required to modify the slope and shape the lagoon. The walls or sides of shallow excavations can be shored to prevent sloughing or caving. This soil generally is suited to dwellings. Small commercial buildings need to be designed to accommodate the slope, or the soil can be graded to an acceptable gradient. Cuts and fills generally are needed to provide a suitable grade for roads and streets.

This soil is assigned to capability units VIe-5, dryland, and IVe-10, irrigated, to the Sandy range site, and to windbreak suitability group 7.

SbB—Satanta very fine sandy loam, 1 to 3 percent slopes. This is a deep, very gently sloping, and well drained soil on uplands. The areas range from 15 to 400 acres in size.

Typically, the surface layer is grayish brown, very friable, and about 9 inches thick. It is very fine sandy loam in the upper part and loam in the lower part. The subsoil is about 21 inches thick. It is grayish brown, firm clay loam in the upper part; light brownish gray, firm loam in the middle part; and light yellowish brown, firm loam in the lower part. The underlying material is light gray, calcareous loam to a depth of more than 60 inches. In some areas, the soil is grayish brown to a depth of more than 20 inches. In places the subsoil has more sand. Also, in some places weakly cemented caliche is at a depth of 40 to 60 inches.

Included with this soil in mapping are small areas of Creighton soils. Creighton soils are coarser textured than the Satanta soil and are on a similar landscape. These soils make up 2 to 8 percent of the map unit.

Permeability is moderate. The available water capacity is high. The content of organic matter is moderately low. The water intake rate is moderately low. Runoff is slow. Tilth is good.

Most of the acreage of this soil is farmed. Some areas are irrigated. A few small areas are in native grasses, which are used for grazing or are mowed for hay.

Under dryland management, this soil is suited to wheat and introduced grasses. Soil blowing and water erosion are hazards if the surface is not adequately protected by crops or crop residue. Rainfall may not be sufficient during the growing season. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion as well as conserve soil moisture. Terracing and farming on the contour help prevent serious water erosion. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and also increase infiltration of water. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, alfalfa, sugar beets, and pinto beans. Introduced grasses can be grown for hay or pasture. This soil is better suited to

gravity irrigation than to sprinkler irrigation because of the moderately low water intake rate. Soil blowing and water erosion are hazards if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help reduce soil blowing and water erosion and also conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain the content of organic matter and fertility and also increase infiltration of water.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to adapted trees and shrubs in all types of windbreaks. Limited rainfall, competition for moisture from weeds and grasses, and soil blowing are the major hazards and limitations. Irrigation can supply moisture in periods of low rainfall. Cultivation between the tree rows with conventional equipment and herbicides in the row help control weeds and undesirable grasses. Strips of sod or a cover crop between the tree rows can reduce soil blowing.

This soil generally is suited to use as septic tank absorption fields and as sites for houses and small commercial buildings. Sewage lagoons need to be lined or sealed to prevent seepage. Grading is required to modify the slope and shape the lagoon. Good surface drainage reduces damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help provide the needed surface drainage.

This soil is assigned to capability units IIe-1, dryland, and IIe-4, irrigated, to the Silty range site, and to windbreak suitability group 3.

SbC—Satanta very fine sandy loam, 3 to 6 percent slopes. This is a deep, gently sloping, and well drained soil on uplands. The areas range from 15 to 300 acres in size.

Typically, the surface layer is grayish brown, very friable very fine sandy loam in the upper part and dark grayish brown, very friable loam in the lower part. It is about 12 inches thick. The subsoil is about 17 inches thick. It is grayish brown, friable sandy clay loam in the upper part; grayish brown, very friable loam in the middle part; and pale brown, very friable, calcareous loam in the lower part. The underlying material is very pale brown, calcareous very fine sandy loam to a depth of more than 60 inches. In some areas, weakly cemented caliche is at a depth of 40 to 60 inches. Also, in places the subsoil has more sand.

Included with this soil in mapping are small areas of Creighton soils. Creighton soils are coarser than the Satanta soil and are on about the same kind of landscape. These soils make up 5 to 10 percent of the map unit.

Permeability is moderate. The available water capacity is high. The content of organic matter is moderately low. The water intake rate for irrigation is moderately low. Runoff is medium. Tilth is good.

Most of the acreage of this soil is farmed. Some areas are irrigated. A few small areas are in native grasses, which are used for grazing or are mowed for hay.

Under dryland management, this soil is suited to wheat and introduced grasses. Soil blowing and water erosion are hazards if the surface is not adequately protected by crops or crop residue. The main limitation is insufficient rainfall during the growing season. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion as well as conserve soil moisture. A common practice is to summer-fallow before planting winter wheat. This soil can be terraced and farmed on the contour to help prevent serious water erosion. Crop residue, green manure crops, and feedlot manure help maintain the content of organic matter and fertility and increase the infiltration of water.

Under sprinkler irrigation, this soil is suited to corn, alfalfa, and introduced grasses for hay or pasture. Water erosion and soil blowing are hazards if the surface is not adequately protected by crops or crop residue. Efficient management of irrigation water is a concern. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help reduce water erosion and soil blowing and also conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve organic matter content and fertility and also increase the infiltration of water.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can result in severe soil losses from water erosion. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to adapted trees and shrubs in windbreaks and shelterbelts. Limited rainfall, soil blowing, competition for moisture from weeds and grasses, and slope and excessive runoff are the major hazards and limitations. Irrigation can supply moisture in periods of low rainfall. Strips of sod or a cover crop between the rows can reduce soil blowing. Cultivation between the rows with conventional equipment and appropriate herbicides in the row help control weeds and undesirable grasses. Trees can be planted on the contour in

combination with terraces to help reduce erosion and excessive runoff.

This soil generally is suited to use as septic tank absorption fields and as a site for dwellings. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded. Good surface drainage reduces damage to roads and streets by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-l, dryland, and IIIe-4, irrigated, to the Silty range site, and to windbreak suitability group 3.

Sc—Scott silt loam, 0 to 1 percent slopes. This is a deep, nearly level, poorly drained soil in concave depressions on the loess uplands. Runoff from nearby slopes ponds on the soil in spring and early in summer. Areas range in size from 5 to 50 acres.

Typically, the surface layer is grayish brown, very friable silt loam about 2 inches thick. The subsurface layer is gray, very friable silt loam about 2 inches thick. The subsoil is about 28 inches thick. It is dark gray, very firm silty clay in the upper part and light brownish gray, very firm silty clay loam in the lower part. The underlying material to a depth of more than 60 inches is pale brown silt loam. In some places, weakly cemented caliche is at a depth between 50 and 60 inches.

Included with this soil in mapping are small areas of Goshen and Kuma soils. These soils have less clay in the subsoil than the Scott soil, are better drained, and are higher on the landscape. The included soils make up less than 5 percent of the map unit.

Permeability is very slow, and the available water capacity is high. Water ponds on this soil. The content of organic matter is moderate. This soil absorbs water very slowly, and the clayey subsoil releases moisture slowly to plants. The subsoil is very hard when dry. Because the soil is ponded for part of the year and dry at other times, it is difficult to work because it is either too wet or too hard. The perched water table ranges from 6 inches above the soil surface to 12 inches below the surface. Maintaining tilth is difficult.

About 75 percent of this soil is farmed, and the remaining 25 percent is idle. Crops can be grown in years when the annual rainfall is below normal. In years when rainfall is normal to above average, the soil is too wet for planting.

Under dryland management, this soil is poorly suited to wheat, forage sorghum, and introduced grasses. Diversions around the depressions help reduce the risk of ponding. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and increase the infiltration of water.

This soil is not suited to irrigated crops, grasses, and trees.

This soil generally is not suited to use as septic tank absorption fields because of wetness and the very slow permeability. Sewage lagoons need to be diked to a level well above that of water that collects and ponds on this soil. This soil is not suited to use as building sites because of ponding and the shrinking and swelling of the soil. Roads and streets need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance. Constructing roads on suitable, well compacted fill material above the ponding level and providing adequate side ditches and culverts help protect roads against damage by ponding and wetness. Frost action can be reduced by placing a gravel moisture barrier in the subgrade and crowning the road by grading.

This soil is assigned to capability unit IVw-2, dryland, and to windbreak suitability group 10. No range site is assigned.

TaB—Tassel-Duda loamy sands, 0 to 3 percent slopes. This complex consists of shallow Tassel soil and moderately deep Duda soil. Both soils are well drained, are gently undulating, and are on uplands. The Tassel soil is on the lower part of the landscape, and the Duda soil is on the higher part. The areas of these soils are so intricately mixed or so small that it was not practical to map them separately. The mapped areas of this complex are about 50 to 60 percent Tassel soil and about 20 to 30 percent Duda soil and range in size from 15 to 480 acres.

Typically, the Tassel soil has a surface layer of grayish brown, loose loamy sand about 6 inches thick. The subsurface layer is pale brown, very friable, calcareous fine sandy loam about 3 inches thick. The underlying material is very pale brown, calcareous fine sandy loam 7 inches thick. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is fine sand or sand.

Typically, the Duda soil has a surface layer of dark brown, loose loamy sand about 4 inches thick. Below that, there is a transition layer of brown, loose sand about 6 inches thick. The underlying material is 20 inches thick. It is light yellowish brown sand in the upper part and very pale brown, calcareous loamy sand in the lower part. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is fine sand or sand.

Included in mapping are small areas of Valent soils. Valent soils are deep and are coarser textured than the Tassel soil. Valent soils are on the same type of

landscape as Tassel and Duda soils. The included soils make up 10 to 15 percent of the mapped areas.

Permeability is moderately rapid in the Tassel soil and rapid in the Duda soil. The content of organic matter is low. The available water capacity is very low.

Most of the acreage is in native grasses, which are used for grazing or mowed for hay. In a few areas, the soils are used for irrigated crops.

These soils are not suited to dryfarming because they have a very low available water capacity and are highly susceptible to soil blowing.

Under irrigation, the soils are only poorly suited to corn, alfalfa, and introduced grasses. Soil blowing is a severe hazard if the surface is not adequately protected by crops or crop residue. The very low available water capacity and the shallow to moderately deep root zone are limitations. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

These soils are suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing reduces the protective cover and causes deterioration of the native plants. It can also result in severe soil losses from soil blowing and cause small blowouts. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

The Tassel soil is not suited to trees and shrubs in windbreaks because it is too shallow and limy for trees to survive and grow. The Duda soil is suited to adapted trees and shrubs in windbreaks. Onsite investigation is needed to properly plan a windbreak in areas of this complex. The limitations and hazards on the Duda soil are loose surface soil, soil blowing and covering of seedlings by drifting sand in high winds, insufficient moisture, and competition from weeds and undesirable grasses. Maintaining sod between the tree rows reduces soil blowing. Trees need to be planted in a shallow furrow with minimal disturbance of the soil to guard against soil blowing. Irrigation can supply water in periods of low rainfall. Competition from weeds and undesirable grasses can be controlled by maintaining sod between the rows and in the rows. Areas close to the trees can be hoed by hand.

The Duda soil generally is suited to use as a site for houses without basements, for small commercial buildings, and for local roads and streets. Onsite investigation is needed. The Tassel soil generally is not suited to septic tank absorption fields and sewage lagoons because of its shallowness to bedrock. On the Duda soil, building up or mounding the septic tank absorption field site with suitable fill material increases the filtering capacity of the field. Seepage can contaminate the ground water. Sewage lagoons can be constructed on the Duda soil if the bottom of the lagoon is sealed after excavation to prevent seepage. On the Duda soil, the walls or sides of shallow excavations can be shored to prevent sloughing or caving. On both Tassel and Duda soils, the soft bedrock generally can be easily excavated in constructing houses with basements or buildings that have deep foundations. On the Tassel soil, the soft bedrock needs to be excavated for roads and streets.

The soils in this complex are assigned to capability units VIs-4, dryland, and IVs-11, irrigated. The Tassel soil is in the Shallow Limy range site and in windbreak suitability group 10. The Duda soil is in the Sandy range site and in windbreak suitability group 7.

TaF—Tassel-Duda loamy sands, 3 to 30 percent slopes. This complex consists of shallow Tassel soil and moderately deep Duda soil. Both soils are well drained and are on uplands. The Tassel soil is steeply sloping and generally is on the crest and shoulders of ridges and hills. The Duda soil is below the Tassel soil on concave slopes. The areas of these soils are so intricately mixed or so small that it was not practical to map them separately. The mapped areas of this complex are about 50 to 60 percent Tassel soil and about 20 to 30 percent Duda soil and range in size from 15 to 320 acres.

Typically, the Tassel soil has a surface layer of brown, loose loamy sand about 8 inches thick. The underlying material is light brownish gray, calcareous fine sandy loam to a depth of 16 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is fine sand.

Typically, the Duda soil has a surface layer of grayish brown, loose loamy sand about 4 inches thick. Below that, there is a transition layer of light brownish gray, calcareous, loose sand about 5 inches thick. The underlying material is pale brown, calcareous sand in the upper part and very pale brown, calcareous loamy sand in the lower part, to a depth of 26 inches. Below that, white, calcareous, weakly cemented caliche extends to a depth of more than 60 inches. In a few small areas, the surface layer is loamy fine sand or sand.

Included with these soils in mapping are small areas of Valent soils. Valent soils are deep and are at a higher elevation than the Tassel and Duda soils. The included soils make up 10 to 15 percent of the mapped areas.

Permeability is moderately rapid in the Tassel soil and rapid in the Duda soil. The available water capacity of these soils is very low. The content of organic matter is low.

The soils of this complex are in native grasses, which are used for grazing. The soils are not suited to farming because of the very low available water capacity, the shallow to moderately deep root zone, the slope, and the susceptibility to water erosion and soil blowing.

These soils are suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing reduces the protective cover and causes deterioration of the native plants. It can also cause severe losses from soil blowing and small blowouts. Proper grazing use, timely deferment of grazing, and a system of use and rest that varies from year to year help maintain or improve the range condition.

The Tassel soil is not suited to trees and shrubs; it is too shallow, steep, droughty, and limy for most trees to survive. The Duda soil is suited to adapted trees and shrubs in windbreaks. Onsite investigation is needed to properly plan a windbreak in areas of this complex.

Onsite investigation is needed before any engineering works are started. The Tassel soil generally is not suited to septic tank absorption fields and sewage lagoons because of the shallow depth to bedrock and the steep slopes. On the Duda soil, building up or mounding the septic tank absorption field with suitable fill material increases the filtering capacity of the field. Care should be taken that seepage does not contaminate the ground water. Sewage lagoons can be constructed on the Duda soil if the soil is graded to modify the slope and if, after excavation, the bottom of the lagoon is sealed to prevent seepage. On the Duda soil, the walls or sides of shallow excavations can be shored to prevent sloughing or caving. On both Tassel and Duda soils, houses and small commercial buildings need to be designed to accommodate the slope, or the soil can be graded. The soft bedrock generally can be easily excavated in constructing houses with basements. Cuts and fills generally are needed to provide a suitable grade for roads and streets, and the soft bedrock needs to be excavated.

The soils in this complex are assigned to capability unit VIs-4. The Tassel soil is in the Shallow Limy range site and in windbreak suitability group 10. The Duda soil is in the Sandy range site and in windbreak suitability group 7.

UsC2—Ulysses silt loam, 3 to 6 percent slopes, eroded. This is a deep, well drained, gently sloping soil on ridgetops and side slopes of natural drainageways on uplands. Small rills and gullies 4 to 8 inches deep are numerous. The areas of this soil range from 15 to 125 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsoil is brown, very friable silt loam about 7 inches thick. The underlying material is pale brown silt loam in the upper part and very pale brown silt loam in the lower part to a depth of more than 60 inches. In a few small areas, the dark surface layer and part of the subsoil have been removed by erosion.

Included with this soil in mapping are small areas of Colby and Keith soils. Colby soils are in higher positions on the landscape, and, unlike the Ulysses soil, they do not have a dark surface layer or a subsoil. Keith soils are on about the same kind of landscape as the Ulysses soil and have a finer textured subsoil. The included soils make up 10 to 15 percent of the map unit.

Permeability is moderate. The available water capacity is high. Runoff is medium. The water intake rate is moderate. The content of organic matter is moderately low. This soil releases moisture readily to plants.

Most of the acreage is farmed, but a few areas are in native grasses, which are used for grazing or mowed for hay. Under dryland management, this soil is suited to wheat. Introduced grasses can be grown for hay or pasture. The main hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. A shortage of rainfall during the growing season is a limitation. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and tilth and increase infiltration of water. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, this soil is suited to corn, alfalfa, and introduced grasses. The main hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help reduce water erosion and soil blowing as well as conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can result in severe soil losses from water erosion. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to adapted trees and shrubs in windbreaks. Limitations and hazards to survival and growth are inadequate rainfall, a high content of lime, excessive runoff, competition from weeds and grasses, and soil blowing. Irrigation can supply moisture in periods of insufficient rainfall. Only those species that tolerate a high content of calcium should be planted. Planting trees on the contour in combination with terraces allows normal cultivation between the rows, which helps in storing moisture and in controlling weeds. Applying appropriate herbicides or hoeing by hand controls weeds in the row. A cover crop can reduce soil blowing.

This soil is generally suited to use as septic tank absorption fields and sites for houses with basements.

Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and shape the lagoon. Foundations for houses without basements and small commercial buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded. Roads and streets need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance.

This soil is assigned to capability units IIIe-1, dryland, and IIIe-6, irrigated, to the Silty range site, and to windbreak suitability group 8.

UsD2—Ulysses silt loam, 6 to 9 percent slopes, eroded. This is a deep, well drained, strongly sloping soil on side slopes of natural drainageways on uplands. Small rills and gullies 4 to 10 inches deep are numerous. The areas of this soil range from 15 to 150 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 5 inches thick. The subsoil is grayish brown, very friable silt loam about 5 inches thick. The upper part of the underlying material is light brownish gray silt loam, and the lower part is very pale brown silt loam to a depth of more than 60 inches. In a few small areas, the dark surface layer and part of the subsoil have been removed by erosion.

Included with this soil in mapping are small areas of Colby and Keith soils. Unlike the Ulysses soil, Colby soils do not have a dark surface layer or a subsoil. Colby soils are higher on the landscape than the Ulysses soil. Keith soils are on the same kind of landscape as the Ulysses soil, and they have a more developed subsoil. The included soils make up 10 to 18 percent of the map unit.

Permeability is moderate, and the available water capacity is high. Runoff is medium to rapid. The irrigation water intake rate is moderate. The content of organic matter is moderately low. This soil releases moisture readily to plants.

Under dryland management, this soil is poorly suited to wheat and introduced grasses. The major hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. Rainfall during the growing season may not be sufficient. Terraces, farming on the contour, and grassed waterways protect against serious water erosion. Stubble mulching, chiseling, discing, and other tillage practices that keep all or part of the crop residue on the surface help prevent water erosion and soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and soil tilth and increase infiltration of water. Summer fallow is used if wheat is grown.

Under sprinkler irrigation, this soil is poorly suited to corn, alfalfa, and introduced grasses. The major hazards are water erosion and soil blowing if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage practices that keep all or part of the crop residue on the surface help reduce water erosion and soil blowing as well as conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can result in severe soil losses from water erosion. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to adapted trees and shrubs in windbreaks. The limitations and hazards are drought, a high content of lime, strong slopes and excessive runoff, competition from weeds and undesirable grasses, and soil blowing. Irrigation can supply moisture in periods of insufficient rainfall. Only those trees and shrubs that tolerate a high content of lime should be planted. Planting trees on the contour in combination with terraces allows normal cultivation between the tree rows, which helps in storing moisture and controlling weeds. Weeds and grasses in the row can be controlled by hand hoeing or by herbicides. A cover crop can reduce soil blowing.

Land shaping and contour installation generally are necessary for proper operation of septic tank absorption fields. Sewage lagoons need to be lined or sealed to prevent seepage, and grading is required to modify the slope and to shape the lagoon. This soil generally is suited to use as a site for houses with basements. Foundations for houses without basements and small commercial buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil. Small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded to an acceptable gradient. Roads and streets need to be designed so that the pavement and subbase are thick enough to compensate for the low strength of the soil. Coarser material can be used for subgrade or base material to ensure better performance.

This soil is assigned to capability units IVe-1, dryland, and IVe-6, irrigated, to the Silty range site, and to windbreak suitability group 8.

VaF—Valent sand, rolling. This is a deep, rolling, excessively drained soil on uplands. Slope ranges from 9 to 17 percent. The areas of this soil range from 15 to 3,000 acres in size.

Typically, the surface layer is grayish brown, loose sand about 4 inches thick. The underlying material is light yellowish brown sand to a depth of more than 60 inches. In a few small areas, the surface layer is loamy sand or fine sand. In some areas, the surface layer is darker and is more than 10 inches thick.

Included with this soil in mapping are small areas of Duda and Tassel soils. Duda soils are well drained, have weakly cemented caliche at a depth of 20 to 40 inches, and are in lower positions on the landscape. Tassel soils are well drained, have weakly cemented caliche at a depth of 10 to 20 inches, and are at a lower elevation than the Valent soil. The included soils make up 8 to 10 percent of the map unit.

Permeability is very rapid, and the available water capacity is low. Runoff is slow. The content of organic matter is low.

Most of the acreage of this soil is in native grasses, which are used for grazing or are mowed for hay. This soil is not suited to cultivation because it is highly susceptible to soil blowing and water erosion.

This soil is suited to use as rangeland (fig. 12), and this use is effective in controlling water erosion and soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Severe losses from soil blowing and small blowouts can also result. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help to maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded cropland.

This soil is suited to trees and shrubs in windbreaks for farmsteads and fields. The major hazards and limitations are loose surface soil, soil blowing and covering of seedlings by drifting sand in high winds, insufficient moisture, competition from weeds and undesirable grasses, and water erosion. Maintaining a cover of sod between the tree rows helps reduce soil blowing. Trees need to be planted in a shallow furrow with little disturbance of the soil to prevent soil blowing.

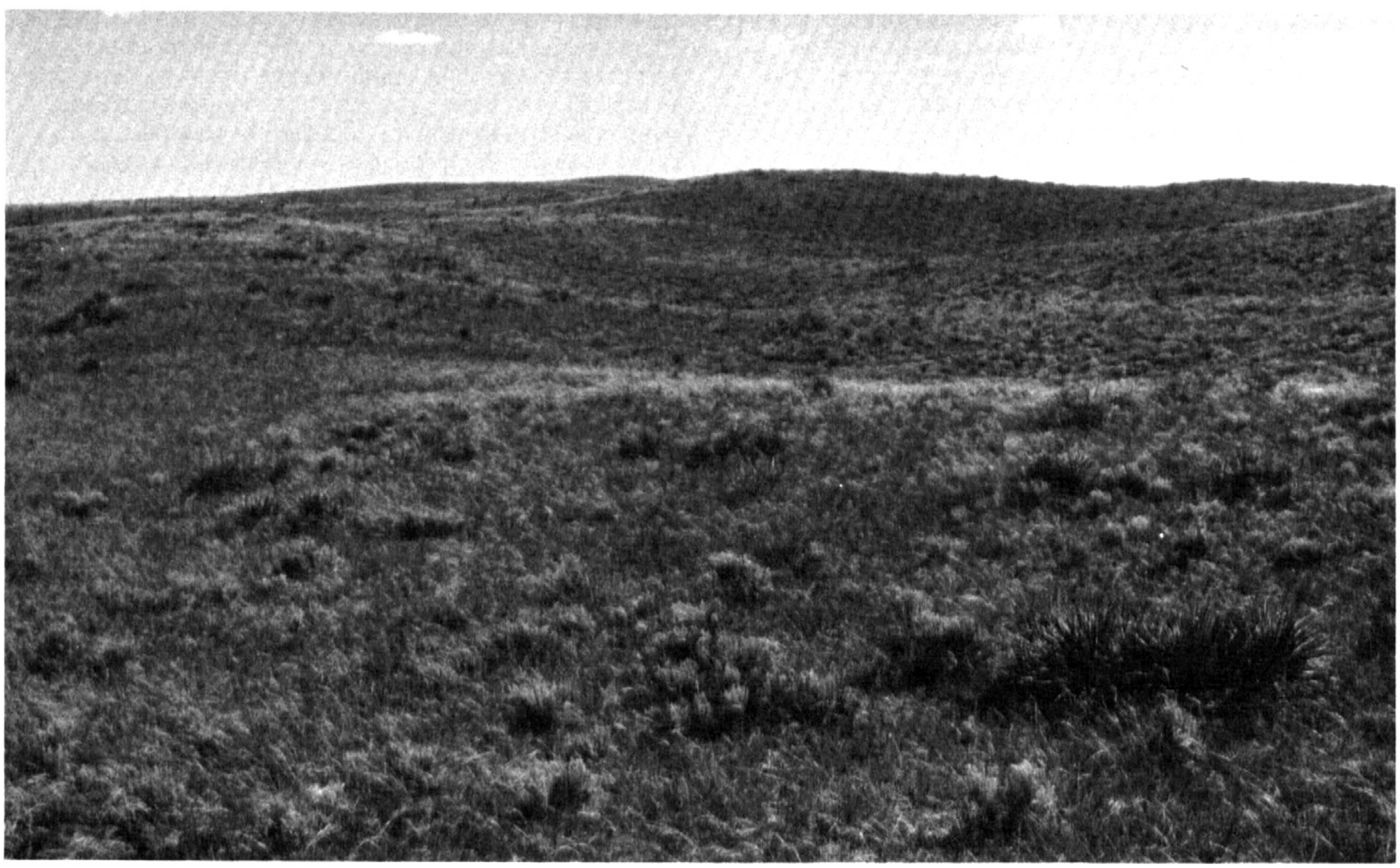

Figure 12.—An area of Valent sand, rolling. This soil is suited to use as rangeland.

Irrigation can supply water during periods of insufficient moisture. Sod needs to be maintained between the rows and in the rows to prevent competition from weeds and undesirable grasses. Hand hoeing can control weeds close to the trees. Planting trees on the contour and maintaining strips of sod between the rows can prevent water erosion. Generally, water erosion is not a severe problem.

Land shaping and installation on the contour generally are necessary for proper operation of a septic tank absorption field. Seepage from the septic tank absorption field can contaminate ground water. Sewage lagoons need to be lined or sealed to prevent seepage, and extensive grading is required to modify the slope and shape the lagoon. The walls or sides of shallow excavations can be temporarily shored to prevent sloughing or caving. Houses and small commercial buildings need to be properly designed to accommodate the slope, or the soil can be graded. Cuts and fills generally are needed to provide a suitable grade for roads and streets.

This soil is assigned to capability unit VIe-5, dryland, to the Sands range site, and to windbreak suitability group 7.

VaG—Valent sand, rolling and hilly. This is a deep, excessively drained soil on rolling and hilly uplands. Slopes range from 14 to 60 percent. The slopes are broken in numerous places by soil slippage or "catsteps." Many small blowouts and a few large blowouts 3 to 8 acres in size and 10 to 20 feet deep are on the very steep side slopes where plant cover is sparse. The areas of this soil range from 15 to 1,500 acres in size.

Typically, the surface layer is grayish brown, loose sand about 4 inches thick. The underlying material is very pale brown sand to a depth of more than 60 inches. In a few areas, the surface layer is fine or coarse sand.

Permeability is very rapid, and the available water capacity is low. Runoff is slow. The content of organic matter is low.

All the acreage of this soil is in native grasses, which are used for grazing. This soil is not suited to farming because of the steep and very steep slopes and because of its susceptibility to soil blowing and water erosion.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing reduces the protective cover and causes deterioration of the native plants. It can result in severe losses from soil blowing and can cause blowouts. Proper grazing use, timely deferment of grazing, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is not suited to trees and shrubs in windbreaks. Some sites can be planted to provide habitat for wildlife if the trees are planted by hand or other special approved practices are used.

This soil generally is not suited to sanitary facilities because of the steep and very steep slopes. The walls or sides of shallow excavations can be shored to prevent sloughing or caving. Houses and small commercial buildings need to be designed to accommodate the slope, or the soil can be graded to an acceptable gradient. Cutting and filling generally are needed to provide a suitable grade for roads and streets.

This soil is assigned to capability unit VIIe-5, dryland, to the Sands and Choppy Sands range sites, and to windbreak suitability group 10.

VcB—Valent loamy sand, 0 to 3 percent slopes. This is a deep, excessively drained soil on nearly level and gently undulating swales of the uplands. The areas of this soil range from 15 to 600 acres in size.

Typically, the surface layer is grayish brown, loose loamy sand about 8 inches thick. The underlying material is pale brown sand to a depth of more than 60 inches. In a few small areas, the surface layer is loamy fine sand or fine sand. In some areas, the dark surface layer is more than 10 inches thick.

Included with this soil in mapping are small areas of Duda, Jayem, and Tassel soils. Duda soils have weakly cemented caliche at a depth of 20 to 40 inches and are slightly above the Valent soil on the landscape. Jayem soils are well drained and are finer textured than the Valent soil; they are on the same kind of landscape. Tassel soils are well drained and are finer textured than the Valent soil; they have weakly cemented caliche at a depth of 10 to 20 inches and are in higher positions on the landscape. The included soils make up 10 to 15 percent of the map unit.

Permeability is very rapid, and the available water capacity is low. Runoff is slow. The water intake rate is very high. The content of organic matter is low.

About half of the acreage of this soil is in irrigated crops, and half is in native grasses, which are used for grazing or are mowed for hay. This soil is not suited to dryland farming because of the very rapid permeability, the low available water capacity, and susceptibility to soil blowing.

Under sprinkler irrigation, this soil is suited to corn, alfalfa, and introduced grasses. Soil blowing is a major hazard if the surface is not adequately protected by crops or crop residue. The low available water capacity is a limitation. Frequent and timely water applications are necessary to prevent crop damage. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing,

improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing also can result in severe losses from soil blowing and from small blowouts. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that changes from year to year help maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded cropland.

This soil is suited to trees and shrubs in windbreaks. The major hazards and limitations are insufficient moisture, soil blowing, and competition for moisture from weeds and undesirable grasses. Irrigation can supply moisture in periods of low rainfall. Strips of sod or a cover crop between the tree rows can control soil blowing. Cultivation or herbicides can control weeds and grasses.

This soil generally is suited to use as a site for houses and small commercial buildings and for local roads and streets. Care should be taken that seepage from septic tank absorption fields does not contaminate the ground water. Sewage lagoons need to be lined or sealed to prevent seepage. The walls or sides of shallow excavations can be shored to prevent sloughing or caving.

This soil is assigned to capability units VIe-5, dryland, and IVe-11, irrigated, to the Sandy range site, and to windbreak suitability group 7.

VcD—Valent loamy sand, 3 to 9 percent slopes. This is a deep, excessively drained, gently sloping and strongly sloping soil on undulating and hummocky uplands. The areas of this soil range from 15 to 1,800 acres in size.

Typically, the surface layer is grayish brown, loose loamy sand about 6 inches thick. The underlying material is pale brown sand to a depth of more than 60 inches. In a few small areas, the surface layer is loamy fine sand or fine sand. In a few small areas, the surface layer is calcareous. In some areas, the dark surface layer is more than 10 inches thick.

Included with this soil in mapping are small areas of Duda, Jayem, and Tassel soils. Duda soils have weakly cemented caliche at a depth of 20 to 40 inches and are on about the same kind of landscape. Jayem soils are well drained, are finer textured than the Valent soil, and are slightly lower on the landscape. Tassel soils are well drained and finer textured than the Valent soil, have weakly cemented caliche at a depth of 10 to 20 inches, and are in lower positions on the landscape. The included soils make up 10 to 15 percent of the map unit.

Permeability is very rapid, and the available water capacity is low. Runoff is slow. The water intake rate is very high. The content of organic matter is low.

About half of the acreage of this soil is irrigated cropland. The other half is in native grasses, which are used for grazing or are mowed for hay. This soil is not suited to dryland farming because of the very rapid permeability, the low available water capacity, and the susceptibility to soil blowing and water erosion.

Under sprinkler irrigation, this soil is suited to corn, introduced grasses, and alfalfa. The major hazards are soil blowing and water erosion if the surface is not adequately protected by crops or crop residue. The low available water capacity is a limitation. Frequent and timely water applications are necessary to supply needed moisture to crops. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing and water erosion as well as conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing and water erosion. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Severe losses from soil blowing and small blowouts can also result. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that changes from year to year help maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded cropland.

This soil is suited to adapted trees and shrubs in farmstead, livestock, and field windbreaks. The major limitations and hazards are loose surface soil, soil blowing and covering of seedlings by drifting sand in high winds, insufficient moisture, and competition from weeds and undesirable grasses. Maintaining sod between the tree rows helps stabilize the loose surface soil. Trees need to be planted in a shallow furrow with minimal disturbance of the soil to prevent soil blowing. Irrigation can supply water in periods of insufficient rainfall. Sod needs to be maintained between the rows and in the rows to prevent competition from weeds and undesirable grasses. Areas near the trees can be hoed by hand.

This soil generally is suited to use as a site for houses and local roads and streets. Care should be taken that seepage from septic tank absorption fields does not contaminate the ground water. Sewage lagoons need to be lined or sealed to prevent seepage, and grading may be required to modify the slope. The walls or sides of shallow excavations can be shored to prevent sloughing or caving. Small commercial buildings need to be designed to accommodate the slope, or the soil can be graded to an acceptable gradient.

This soil is assigned to capability units VIe-5, dryland, and IVe-II, irrigated, to the Sands range site, and to windbreak suitability group 7.

VeB—Vetal fine sandy loam, 0 to 3 percent slopes. This is a deep, well drained, nearly level to very gently

sloping soil in concave swales on uplands. The areas of this soil range from 15 to 200 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 22 inches thick. A transition layer below the surface layer is dark grayish brown, very friable fine sandy loam about 26 inches thick. The underlying material is grayish brown fine sandy loam to a depth of more than 60 inches. In a few small areas, the surface layer is loamy fine sand. In some areas, the dark surface layer is less than 20 inches thick.

Included with this soil in mapping are small areas of Dailey and Haxtun soils. Dailey soils are in about the same position on the landscape as the Vetal soil and are coarser textured throughout. Haxtun soils are on a similar landscape and have a finer textured subsoil. The included soils make up 5 to 10 percent of the map unit.

Permeability is moderately rapid, and the available water capacity is high. The irrigation water intake rate is moderately high. Runoff is slow. The content of organic matter is moderately low. This soil releases moisture readily to plants.

A large part of the acreage of this soil is farmed. The rest is in native grasses, which are used for grazing or are mowed for hay. Under dryland management, this soil is suited to wheat, legumes, and introduced grasses. The major limitation is inadequate rainfall during the growing season. Soil blowing is a major hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help reduce soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, sugar beets, and pinto beans. Alfalfa and introduced grasses can be grown for hay or pasture. Soil blowing is a hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage methods that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing can lead to severe losses from soil blowing and small blowouts. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition. Range seeding may be needed to stabilize severely eroded cropland.

This soil is suited to trees and shrubs in farmstead, livestock, and field windbreaks. The main hazards are insufficient moisture during the growing season, soil blowing, and competition for moisture from weeds and grasses. Irrigation can supply moisture in periods of low rainfall. Sod or a cover crop between the tree rows helps control soil blowing. Weeds and grasses can be controlled by cultivating between the rows with conventional equipment. Herbicides can be applied in the row, or the areas can be hoed by hand or rototilled.

This soil generally is suited to septic tank absorption fields and to use as a site for houses and small commercial buildings. Sewage lagoons need to be lined or sealed to prevent seepage. Good surface drainage reduces damage to roads and streets by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIIe-3, dryland, and IIe-8, irrigated, to the Sandy range site, and to windbreak suitability group 5.

Wa—Wann fine sandy loam, 0 to 2 percent slopes. This is a deep, nearly level, somewhat poorly drained soil on bottom lands. It is occasionally flooded. The areas range from 15 to 450 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 12 inches thick. The underlying material is light gray fine sandy loam in the upper part and very pale brown very fine sandy loam in the lower part to a depth of more than 60 inches. In a few small areas, the surface layer is loam or sandy loam. In a few areas, the underlying material below a depth of 40 inches is sandy loam or loamy fine sand.

Included with this soil in mapping are small areas of Caruso and Gannett soils. Caruso soils are finer textured than the Wann soil and are on the same type of landscape. Gannett soils are very poorly drained and are in slightly lower positions. In places, gravelly sand is at a depth of 20 to 40 inches. The included soils make up 5 to 15 percent of the map unit.

Permeability is moderately rapid. Runoff is slow. The available water capacity is high. The content of organic matter is moderately low, generally between 1 and 2 percent. The water intake rate is moderately high. Tilth is good. The seasonal high water table ranges in depth from about 1.5 feet in wet years to 3.5 feet in dry years.

Most of the acreage of this soil is farmed. In most places, the soil is dry-farmed, but in some places it is irrigated. In a few areas, it is in native grasses that are used for grazing.

Under dryland management, this soil is suited to alfalfa and wheat. Introduced grasses can be grown for hay or pasture. The major hazards are soil blowing, if the surface is not adequately protected by crops or crop residue, and occasional flooding. The major limitation is wetness caused by the water table. Stubble mulching, chiseling, discing, and other tillage practices that keep all or part of the crop residue on the surface help prevent

soil blowing as well as conserve soil moisture. Dikes can help prevent flooding. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter, fertility, and soil tilth.

Under irrigation, this soil is suited to alfalfa, corn, pinto beans, sugar beets, and introduced grasses. The main hazards are occasional flooding and soil blowing if the surface is not adequately protected by crops or crop residue. Wetness early in spring is a limitation because of the shallow depth to the water table. Dikes around the area can help prevent flooding. Stubble mulching, chiseling, discing, and other tillage practices that keep all or part of the crop residue on the surface help prevent soil blowing and also conserve moisture. Lowering the water table by using tile drains helps to dry out the soil early in spring. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland for either grazing or haying. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Also, overgrazing when the soil is wet can cause surface compaction and the formation of small mounds, making grazing or haying difficult. Proper grazing use and timely deferment of grazing or haying, along with restricted use during very wet periods, help maintain the native plants in good condition.

This soil is suited to trees and shrubs in windbreaks. Adapted species that can tolerate occasional wetness generally survive and grow well on this soil. Establishing tree seedlings can be difficult in wet years. The soil can be tilled and the seedlings planted after the soil has dried. The herbaceous vegetation that grows on this soil is abundant and persistent. It can be controlled by cultivating between tree rows with conventional equipment. Weeds that are close to the trees can be controlled by hand hoeing or rototilling.

This soil generally is not suited to septic tank absorption fields and building site development because of flooding. Sewage lagoons need to be lined or sealed to prevent seepage and need to be diked as protection against flooding. Sewage lagoons need to be constructed on fill material to raise the bottom of the lagoon to a sufficient height above the seasonal high water table. Constructing roads on suitable, well compacted fill material above flood level and providing adequate side ditches and culverts help protect roads against flood damage and wetness. Damage to roads caused by frost action can be reduced by providing good surface drainage and by placing a gravel moisture barrier in the subgrade. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage.

This soil is assigned to capability units IIw-6, dryland, and IIw-8, irrigated, to the Subirrigated range site, and to windbreak suitability group 2S.

WoB—Woodly loamy fine sand, 0 to 3 percent slopes. This is a deep, nearly level to very gently sloping, well drained soil on uplands. The areas of this soil range from 15 to 960 acres in size.

Typically, the surface layer is grayish brown, very friable loamy fine sand about 5 inches thick. The subsurface layer is grayish brown, very friable fine sandy loam about 4 inches thick. The subsoil is about 29 inches thick. The upper part is grayish brown, friable sandy clay loam, and the lower part is brown, very friable loam. The underlying material is brown fine sandy loam in the upper part; brown, calcareous very fine sandy loam in the middle part; and very pale brown, calcareous fine sandy loam in the lower part to a depth of more than 60 inches. In a few small areas, the surface layer is loamy sand. There is a dark buried soil in a few areas.

Included in mapping are small areas of Ascalon, Jayem, and Vetal soils. Ascalon soils are on about the same kind of landscape as the Woodly soil. Jayem soils have a coarser subsoil and are slightly higher on the landscape. In Ascalon and Jayem soils, the color of the surface layer extends to a depth of less than 20 inches. Vetal soils have a coarser subsoil and are slightly lower on the landscape. The included soils make up about 10 to 15 percent of each mapped area.

Permeability is moderate. The available water capacity is high. The content of organic matter is moderate. The water intake rate is high. Runoff is slow. This soil releases moisture readily to plants. It is easily tilled within a wide range of moisture content.

Most areas of this soil are used for crops; a few areas are in native grasses, which are grazed or are mowed for hay. Under dryland management, this soil is suited to wheat and introduced grasses. The main hazard is soil blowing if the surface is not adequately protected by crops or crop residue. Inadequate rainfall during the growing season is a limitation. Stubble mulching, chiseling, discing, and other tillage practices that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, pinto beans, sugar beets, alfalfa, and introduced grasses for hay or pasture. Soil blowing is the major hazard if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing and other tillage practices that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of

the native plants. Overgrazing can cause severe losses from soil blowing. Also, it can cause small blowouts. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that varies from year to year help maintain or improve the range condition.

This soil is suited to adapted trees and shrubs in farmstead, field, and livestock windbreaks. The hazards and limitations are insufficient moisture, soil blowing, and competition for moisture from weeds and undesirable grasses. Irrigation can supply moisture in periods of low rainfall. Sod or a cover crop between the tree rows helps control soil blowing. Cultivating between the rows with conventional equipment can control weeds and undesirable grasses. Appropriate herbicides can be applied in the row, or the areas can be hoed by hand or rototilled.

This soil generally is suited to septic tank absorption fields. Sewage lagoons need to be lined or sealed to prevent seepage. This soil generally is suited to houses with basements. Foundations for houses and small commercial buildings need to be strengthened and backfilled with coarse material to prevent damage resulting from the shrinking and swelling of the soil. Good surface drainage reduces damage to roads and streets caused by frost action. Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. The base material for roads and streets can be mixed with additives, for example, hydrated lime, to help prevent shrinking and swelling.

This soil is assigned to capability units IIIe-5, dryland, and IIIe-10, irrigated, to the Sandy range site, and to windbreak suitability group 5.

WpB—Woodly fine sandy loam, 0 to 3 percent slopes. This is a deep, nearly level and very gently sloping, well drained soil on uplands. The areas of this soil range from 15 to 1,280 acres in size.

Typically, the surface layer is grayish brown, very friable fine sandy loam about 5 inches thick. The subsurface layer is dark grayish brown, very friable fine sandy loam about 11 inches thick. The subsoil is about 30 inches thick. The upper part is dark grayish brown, very friable sandy clay loam, and the lower part is light brownish gray, very friable fine sandy loam. The underlying material is light gray sandy loam to a depth of more than 60 inches. In a few small areas, the surface layer is loam, loamy fine sand, or sandy loam. In a few areas, weakly cemented limestone is above a depth of 40 inches. There is a dark buried soil in a few areas.

Included with this soil in mapping are small areas of Ascalon and Jayem soils. Ascalon soils are on about the same kind of landscape as the Woodly soil. Jayem soils have a coarser subsoil and are slightly higher on the landscape. In Ascalon and Jayem soils, the color of the surface layer extends to a depth of less than 20 inches. The included soils make up about 5 to 12 percent of each mapped area.

Permeability is moderate. The available water capacity is high. The content of organic matter is moderate. The water intake rate is moderate. Runoff is slow. This soil releases moisture readily to plants. It is easily tilled within a wide range of moisture content.

Almost all the acreage is farmed, but a few small areas are in native grasses and are used for grazing or mowed for hay. Under dryland management, this soil is suited to wheat and introduced grasses for hay or pasture. The major hazard is soil blowing if the surface is not adequately protected by crops or crop residue. The main limitation is insufficient rainfall during the growing season. Stubble mulching, chiseling, discing, and other tillage practices that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve soil moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility. Summer fallow is used if wheat is grown.

Under irrigation, this soil is suited to corn, pinto beans, sugar beets, alfalfa, and introduced grasses (fig. 13). The main hazard is soil blowing if the surface is not adequately protected by crops or crop residue. Stubble mulching, chiseling, discing, and other tillage practices that keep all or part of the crop residue on the surface help prevent soil blowing as well as conserve moisture. Crop residue, green manure crops, and feedlot manure help maintain or improve the content of organic matter and fertility.

This soil is suited to use as rangeland, and this use is effective in controlling soil blowing. Overgrazing, improper haying time, and improper mowing height reduce the protective cover and cause deterioration of the native plants. Overgrazing can cause severe losses from soil blowing and small blowouts. Proper grazing use, timely deferment of grazing or haying, and a system of use and rest that changes from year to year help maintain or improve the range condition.

This soil is suited to adapted trees and shrubs in farmstead, livestock, and field windbreaks. The major hazards and limitations are insufficient moisture, soil blowing, and competition for moisture from weeds and undesirable grasses. Irrigation can supply moisture in periods of low rainfall. Sod or a cover crop between the tree rows helps control soil blowing. Cultivation generally needs to be restricted to the tree rows. Appropriate herbicides can control weeds and undesirable grasses.

This soil generally is suited to use as a site for septic tank absorption fields and for houses with basements. Sewage lagoons need to be lined or sealed to prevent seepage. Foundations for houses and small commercial buildings need to be strengthened and backfilled with coarse material to prevent damage by the shrinking and swelling of the soil. Good surface drainage reduces damage to roads and streets caused by frost action.

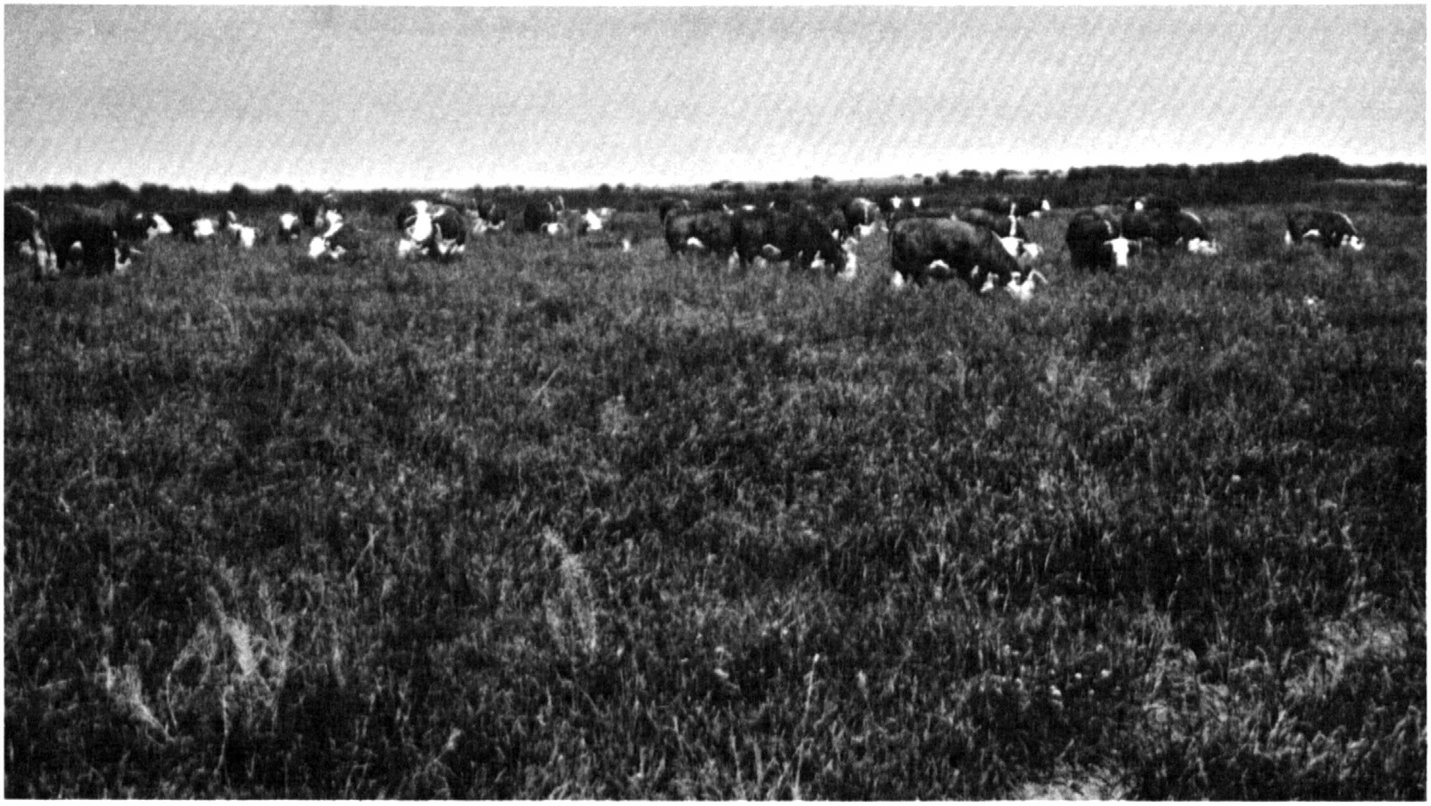

Figure 13.—An irrigated pasture of introduced grasses and legumes on Woodly fine sandy loam, 0 to 3 percent slopes. This soil is suited to use as rangeland.

Crowning the road by grading and constructing adequate side ditches help to provide the needed surface drainage. The base material for roads and streets can be mixed with additives, for example, hydrated lime, to help prevent shrinking and swelling.

This soil is assigned to capability units IIe-3, dryland, and IIe-5, irrigated, to the Sandy range site, and to windbreak suitability group 5.

prime farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in Chase County are listed.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in providing the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have soil properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, rangeland, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban and built-up land or water areas cannot be considered prime farmland.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not frequently flooded during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations or hazards are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

In Chase County, only irrigated soils meet the requirements for prime farmland. These soils make up about 205,750 acres, or nearly 36 percent of the county.

A recent trend in land use has been the conversion of some prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, or difficult to cultivate and less productive than prime farmland.

The following map units make up prime farmland in Chase County. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed soil map units." This list does not constitute a recommendation for a particular land use.

Ac	Alliance silt loam, 0 to 1 percent slopes
Af	Altvan loam, 0 to 1 percent slopes
AfB	Altvan loam, 1 to 3 percent slopes
AsB	Ascalon fine sandy loam, 1 to 3 percent slopes
AsC	Ascalon fine sandy loam, 3 to 6 percent slopes
Bg	Bridget silt loam, 0 to 1 percent slopes
BgB	Bridget silt loam, 1 to 3 percent slopes
BuC	Bushman very fine sandy loam, 1 to 4 percent slopes
Cb	Caruso loam, 0 to 2 percent slopes
CrB	Creighton very fine sandy loam, 1 to 3 percent slopes
CrC	Creighton very fine sandy loam, 3 to 6 percent slopes
Gf	Gibbon silt loam, 0 to 2 percent slopes (where drained) [1]
Gh	Goshen silt loam, 0 to 1 percent slopes
HdB	Haxtun fine sandy loam, 0 to 3 percent slopes
JcB	Jayem fine sandy loam, 0 to 3 percent slopes
JcC	Jayem fine sandy loam, 3 to 6 percent slopes
KeB	Keith silt loam, 1 to 3 percent slopes
KeC2	Keith silt loam, 3 to 6 percent slopes, eroded

[1] This soil generally has been adequately drained, either by some drainage measures or through incidental drainage that results from farming operations, road building, or other kinds of land development.

Ku	Kuma silt loam, 0 to 1 percent slopes
KuB	Kuma silt loam, 1 to 3 percent slopes
KuC	Kuma silt loam, 3 to 6 percent slopes
Ma	Mace silt loam, 0 to 1 percent slopes
MaB	Mace silt loam, 1 to 3 percent slopes
Mc	Mace-Alliance silt loams, 0 to 1 percent slopes
McB	Mace-Alliance silt loams, 1 to 3 percent slopes
Mm	McCash very fine sandy loam, 0 to 1 percent slopes
Mo	McCook silt loam, 0 to 2 percent slopes
Mp	McCook silt loam, occasionally flooded, 0 to 2 percent slopes
Rs	Rosebud loam, 0 to 1 percent slopes
RsB	Rosebud loam, 1 to 3 percent slopes
SbB	Satanta very fine sandy loam, 1 to 3 percent slopes
SbC	Satanta very fine sandy loam, 3 to 6 percent slopes
UsC2	Ulysses silt loam, 3 to 6 percent slopes, eroded
VeB	Vetal fine sandy loam, 0 to 3 percent slopes
Wa	Wann fine sandy loam, 0 to 2 percent slopes
WpB	Woodly fine sandy loam, 0 to 3 percent slopes

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and for windbreaks; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

William E. Reinsch, conservation agronomist, Soil Conservation Service, helped to prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

According to the Nebraska Agriculture Census, 54 percent of the agricultural land in Chase County is planted to crops. The largest acreage is in irrigated corn and dry-farmed wheat fallow, followed by dry-farmed sorghum and alfalfa. About 54 percent of the cropland is irrigated.

The potential of the soils in Chase County for increased production of food is good. Soils in capability classes I through IV are suited to use as cultivated cropland.

The sequence of crops grown on a field, together with the practices needed for the management and conservation of the soil, is called a conservation cropping system. On dry-farmed soils, the cropping system should preserve tilth and fertility, maintain a plant cover that protects the soil from erosion, conserve moisture, and control weeds, insects, and diseases. Cropping systems vary according to the soil on which they are used. For example, a conservation cropping system on Jayem loamy fine sand, 3 to 6 percent slopes, should maintain 2,000 pounds per acre of flat small grain residue on the surface to protect the soil from wind and water erosion. However, on Goshen silt loam, 0 to 1 percent slopes, 1,200 pounds of flat small grain residue per acre is adequate to protect the soil.

In dryfarming, soils need to be worked to prepare a seedbed, to control weeds, and to provide a favorable place for plants to grow. Excessive tillage, however, breaks down the soil's granular structure that is needed for good soil tilth. The cultivation process should be reduced to those steps that are indispensable. Various methods of conservation tillage are used in Chase County. Ecofallow, till-plant, disc or chisel and plant, and stubble mulch are well suited to all the commonly grown crops. Grasses can be established by drilling into a cover of stubble without further seedbed preparation.

dryland management

Good management practices on dry-farmed cropland reduce runoff and the risk of erosion, conserve moisture, and improve tilth. Most of the soils in Chase County are suited to crops. In many places, however, erosion is a severe hazard, and practices to reduce erosion are needed.

Conservation tillage systems that keep crop residue on the surface, terraces, contour farming, and grassed waterways help to reduce water erosion. Crop residue or a protective plant cover on the surface reduces sealing and crusting of the soil during and after heavy rains. In winter, stubble catches drifting snow. The snow then provides additional moisture for plants in the spring. Also, crop residue is a stable bank of plant nutrients that cannot be lost by leaching or volatilization.

Soil blowing is a hazard in Chase County, especially in periods of low rainfall, but the same management practices that control water erosion can be used to control wind erosion. Crop residue left on the soil, conservation tillage, and stripcropping are examples. The overall hazard of erosion can be reduced if the more productive soils are used for row crops and the steeper, more easily erodible soils are used for close-growing crops, such as small grains and alfalfa, or for hay and pasture. Proper land use alone can reduce the hazard of erosion in many places.

Rainfall is the limiting factor in crop production in Chase County. Where wind and water are eroding the soil, a cropping system needs to be planned to fit the soils in each field.

Soils that are used for cultivated crops or for pasture should be tested to determine their need for additional nutrients. Under dryland management, the application of fertilizer should be based on results of soil tests and on the moisture content of the soil at the time of application. When the subsoil is dry and rainfall is low, fertilizer should be applied at a slightly lower rate than when the soil is moist. Nitrogen fertilizer is beneficial to nonlegume crops on all soils. Phosphorus and zinc are needed on the more eroded soils and in cut areas after construction of terraces or diversions. Dry-farmed soils require less fertilizer than irrigated soils because the plant population generally is not so dense.

The best way to protect the soil and reduce erosion on soils in classes IIc, IIw, and IIe is to utilize crop residue, add fertilizer or barnyard manure to increase nutrients, and use other good agronomic practices. On soils in class IIIe, the best practices are: leaving crop residue on the soil over winter, farming on the contour or stripcropping, and using a conservation tillage system that leaves 3,000 pounds per acre of corn residue on the surface or 1,500 pounds per acre of small grain residue. On soils in class IVe, the best practices are: leaving crop residue on the soil over winter, farming on the contour or stripcropping, and using a conservation tillage system that leaves 4,000 pounds per acre of corn or sorghum residue on the surface or 2,000 pounds per acre of small grain residue. Terracing may be needed on slopes of more than 10 percent. Converting cropland to pasture or hayland may be an economic alternative for class IV land.

Some soils in Chase County, notably Scott soils, are subject to ponding. If the water table cannot be lowered sufficiently for good crop growth, crops that are tolerant of wet conditions can be planted.

Herbicides can effectively control weeds. However, care should be taken to apply the correct kind at the proper rate to fit the soil conditions. The colloidal clay and humus fraction of the soil is responsible for most of the chemical activity in the soil. Herbicides can damage crops on sandy soils, which are low in colloidal clay, and on soils that have a moderately low or low content of organic matter. Consequently, the application rate of herbicides on these soils needs to be correspondingly lowered.

irrigation management

About 54 percent of the cropland in Chase County is irrigated. Corn is grown on 73 percent of the irrigated cropland. A smaller acreage is in field beans, sugar beets, and alfalfa hay.

On soils that are well suited to irrigation, the cropping system consists mainly of row crops. A cropping sequence that includes different row crops, small grains, and alfalfa or grass helps to control the diseases and insects that are prevalent if the same crop is grown year after year. Either furrow or sprinkler irrigation is suited to row crops. Alfalfa can be irrigated by border, contour ditch, corrugation, or sprinkler systems. Water for irrigation is drawn from wells and project irrigation canals.

Gently sloping soils, for example, Keith silt loam, 3 to 6 percent slopes, eroded, are subject to water erosion if they are furrow-irrigated down the slope. Under furrow irrigation, these soils can be bench-leveled on the contour or irrigated by contour furrows in combination with parallel terraces. Land leveling increases the efficiency of irrigation because water is more evenly distributed. The efficiency of furrow irrigation can be improved by adding a tailwater recovery system.

On sandy soils, sprinkler irrigation is best, if the water supply is adequate. Terraces and contour farming, in addition to grassed waterways and conservation tillage that keeps crop residue on the surface, help control water erosion on sprinkler-irrigated soils.

On soils such as Ulysses silt loam, 6 to 9 percent slopes, eroded, if a sprinkler irrigation system is installed, the same conservation practices that control water erosion on nonirrigated cropland should be applied. Terraces, contour farming, and tillage practices that leave a protective cover of crop residue on the soil after the row crop is planted are important in conserving water and in protecting the soil from erosion.

In sprinkler irrigation, water is applied at a rate that the soil can absorb without runoff. Sprinklers can be used on the more sloping soils, for example, Valent loamy sand, 3 to 9 percent slopes, as well as on the nearly level soils if conservation practices are used to control erosion. Because the irrigation water can be carefully controlled, sprinklers have special uses in conservation, for example, establishing new pasture on moderately steep slopes. In summer, however, much water is lost through evaporation. Wind drift can cause water to be unevenly applied.

Sprinkler systems are of two general kinds. One kind is set at a certain location and is left there until a specified amount of water has been applied. Another kind consists of sprinkler arms that rotate on a fixed center pivot (fig. 14).

Dailey, Jayem, and Valent soils are low or moderately low in organic matter and have low fertility and poor water holding capacity. Consequently, nitrogen fertilizer can be quickly leached below the root zone and be lost to the crop. To make up for the poor water holding capacity and the low fertility of these soils, fertilizer needs to be applied with the irrigation water at frequent intervals. The amount of water applied, however, has to be carefully controlled.

Soil holds only a limited amount of water. Irrigation water, therefore, is applied at regular intervals to keep the rooting zone moist at all times. The interval varies according to the crop and the time of year. Water should be applied only as fast as the soil can absorb it. Crop residue on the soil surface can increase the intake rate and can slow evaporation under sprinkler irrigation.

Irrigated silt loam and loam soils hold about 2 inches of available water per foot of soil depth. A soil that is 4 feet deep and is planted to a crop that sends its roots to that depth can hold about 8 inches of available water for that crop. Maximum efficiency of furrow irrigation is attained if the irrigation process is started when about one-half of the stored water has been used by the plants. Thus, if a soil holds 8 inches of available water, irrigation should be started when about 4 inches have been removed by the crop. Irrigation sets or systems should be planned to replace the amount that is used by the crop.

A tailwater recovery pit can be installed at the lower end of a furrow-irrigated field to trap runoff of excess irrigation water. This water can then be pumped to the

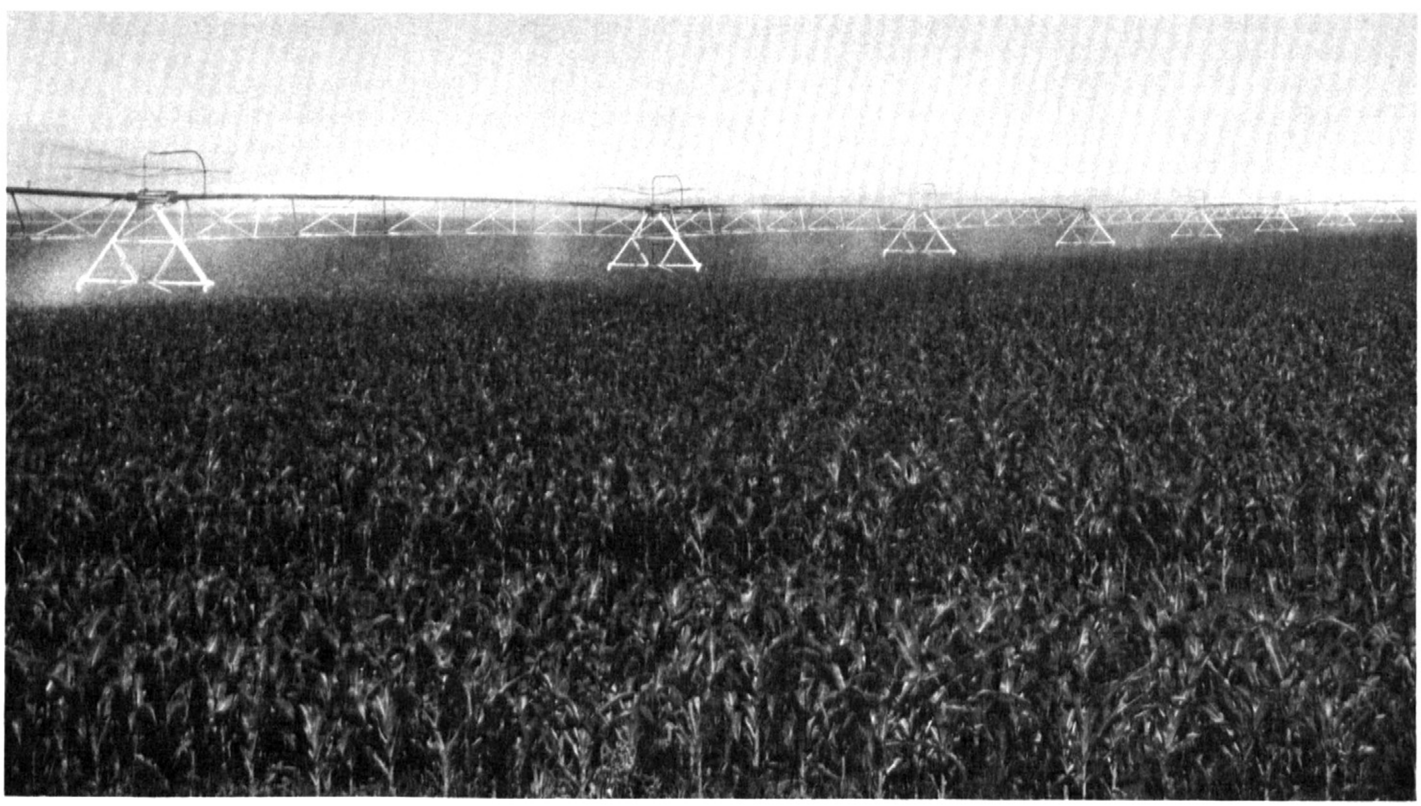

Figure 14.—Corn on Woodly fine sandy loam, 0 to 3 percent slopes. A center pivot sprinkler irrigation system is in use.

upper end of the field and used again. This practice increases the efficiency of the irrigation system and helps conserve the supply of ground water.

All of the soils in Nebraska have been placed in irrigation design groups. These design groups are described in the Nebraska Irrigation Guide (*11*), which is part of the technical specifications for conservation in Nebraska. In the section "Detailed soil map units," after each map unit description, the arabic numerals following the capability unit for irrigated soils indicate the irrigation design group of the soils, for example, capability unit IIe-8, irrigated.

Assistance in planning and designing an irrigation system is available through the local office of the Soil Conservation Service or the county agricultural agent.

pasture and hayland management

The grasses in a pasture or on hayland need to be kept productive. A rotation grazing system that meets the needs of the plants and promotes uniform utilization of forage is important if high returns are expected. Many forages are a good source of minerals, vitamins, proteins, and other nutrients; thus, a well managed pasture can provide a balanced ration throughout the growing season. Irrigated pasture requires a high level of management if it is to produce maximum returns.

A mixture of grasses and legumes can be grown on many kinds of soils. Grasses and legumes are compatible with grain crops in a crop rotation and have beneficial soil building effects. They improve tilth, add organic matter, and reduce erosion. They are an ideal crop for use in a conservation cropping system.

Pasture and hayland, both dryland and irrigated, require the addition of plant nutrients for maximum production. The kind and amount of fertilizer needed should be determined by a soil test.

With high level management, irrigated pasture in Chase County can produce 750 to 900 pounds of beef per acre. Irrigated pasture is an economic alternative in choosing a resource management system for irrigated cropland.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green-manure crops; and harvesting that insures the smallest possible loss.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIe-6.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

Peter N. Jensen, range conservationist, Soil Conservation Service, helped to prepare this section.

Rangeland makes up approximately 45 percent of the agricultural land in Chase County. There are extensive areas of rangeland on the sandy uplands in the northeastern and southwestern parts of the county. Also, the broken lands associated with Frenchman Creek and the seasonally wet flood plains of Frenchman, Stinking Water, and Spring Creeks are largely used as rangeland. Rangeland is common in the Valent, Colby, Gannett-Wann-Gibbon, and Otero-Canyon soil associations.

Most of the rangeland is in the Sands, Sandy, and Limy Upland range sites. The rest is in the Silty, Subirrigated, Choppy Sands, Shallow Limy, Silty Lowland, Silty Overflow, Saline Lowland, Saline Subirrigated, Thin Loess, and Wet Land range sites. The average size of ranches or livestock farms in Chase County is about 1,600 acres.

The raising of livestock, mainly cow and calf herds (calves are sold in the fall as feeders), is the second largest agricultural industry in the county. The rangeland generally is grazed from late in spring to early in fall. The cattle graze corn or grain sorghum aftermath in fall and early in winter. They are fed alfalfa hay or native hay or both, silage, or hay and silage for the rest of the year. Also, the native forage commonly is supplemented with protein.

Approximately one-half of the rangeland has been depleted or is not producing its potential in native forage because of overuse by livestock. Commonly, these overgrazed pastures are producing an abundance of low-quality grasses and forbs. Range management practices that can increase the productivity of rangeland are proper grazing use, deferment or rest, planned grazing systems, range seeding, and weed and brush management.

Each soil in Chase County has been placed in a range site according to the kind and amount of vegetation that grows on the soil when the site is in climax condition. The name of the range site is given at the end of the map unit description. Information about each range site is available at the local office of the Soil Conservation Service. Farmers who want technical help in reseeding cropland to grass, setting up a planned grazing system, or other aspects of a range program can obtain help from the local office of the Soil Conservation Service.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 7 shows, for each soil, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 7 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current

year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management

Figure 15.—Eastern redcedars provide protection against soil blowing on Woodly fine sandy loam, 0 to 3 percent slopes.

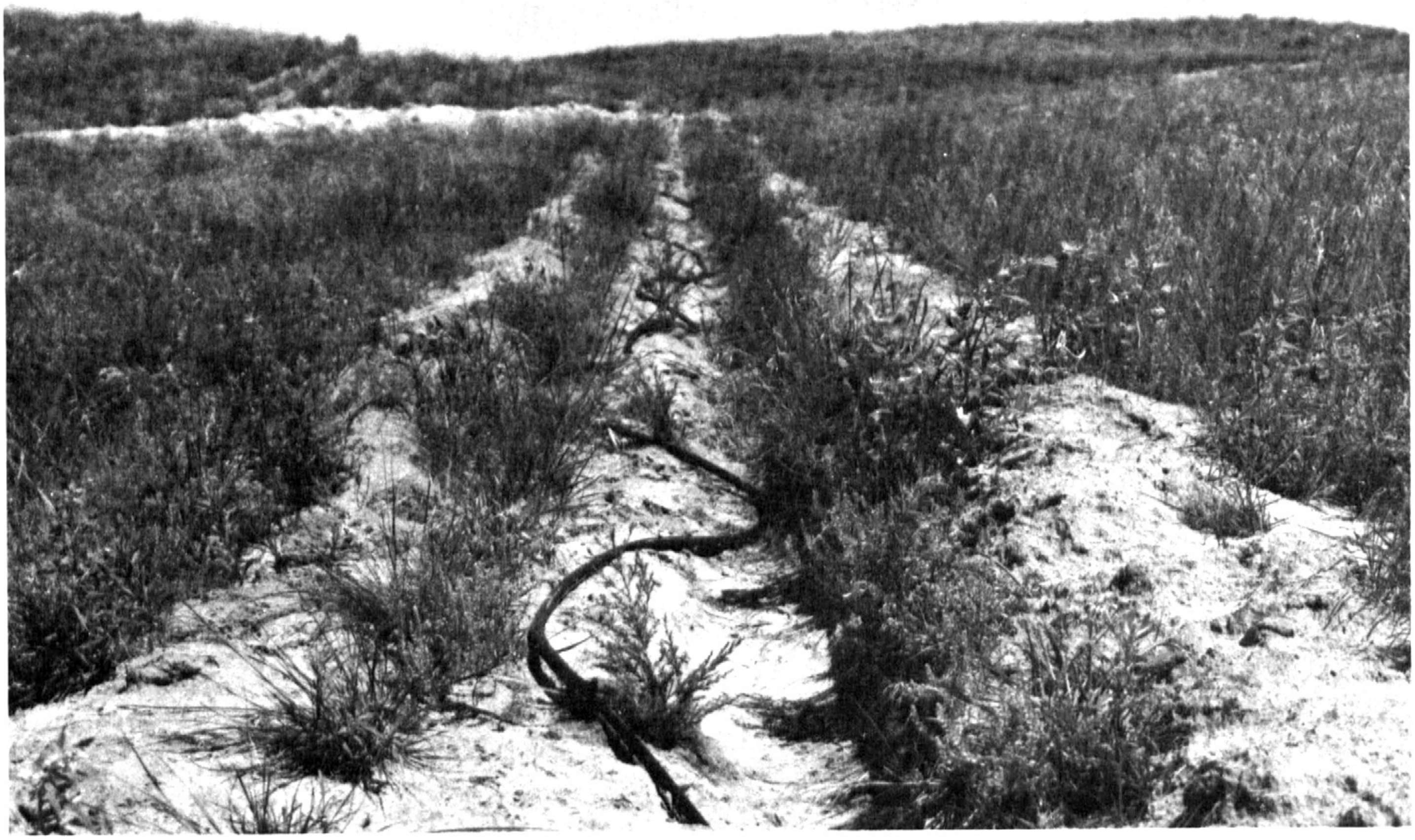

Figure 16.—A drip irrigation system supplies water to eastern redcedar seedlings planted in a windbreak on Valent loamy sand, 3 to 9 percent slopes.

generally results in the optimum production of vegetation, reduction of undesirable brush species, conservation of water, and control of water erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

windbreaks and environmental plantings

Keith A. Ticknor, forester, Soil Conservation Service, helped to prepare this section.

Most of the trees on ranches and farms in Chase County were planted after the ranches and farms were established. In addition, many field windbreaks or shelterbelts have been planted. Few trees or shrubs grow naturally in the county.

Shelterbelts range from a single row to 10 rows. They are planted along fences and at planned intervals across fields. American plum, eastern redcedar, Rocky Mountain juniper, green ash, ponderosa pine, honeylocust, Siberian elm, Russian-olive, common hackberry, and Russian mulberry are commonly used in shelterbelts and farmstead windbreaks. Field windbreaks mainly consist of Siberian elm and eastern redcedar (fig. 15).

The trees and shrubs in windbreaks must be matched with the soil not only to survive but also to grow well. Permeability, the available water capacity, and fertility of the soil greatly affect the rate of growth of trees and shrubs in windbreaks.

The moisture supply is crucial to tree survival in Chase County. Proper site preparation before planting and control of weeds or other competing plants after planting are the major concerns in establishing and managing a windbreak. Supplemental watering by drip irrigation or other methods significantly improves the survival rate and vigor of seedlings during the period of establishment (fig. 16).

Many older windbreaks and shelterbelts are deteriorating because of crowded growing conditions or because short-lived trees, such as Siberian elm, have

reached or passed maturity. Renovation is needed to restore the effectiveness of the windbreaks.

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and tall-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Each soil in Chase County has been assigned to a windbreak suitability group. The name of the group is given at the end of the map unit description. Information about the windbreak groups is available at the local office of the Soil Conservation Service.

recreation

Robert O. Koerner, biologist, Soil Conservation Service, helped to prepare this section.

In Chase County, several recreation areas are maintained and operated by the Nebraska Game and Parks Commission.

The Enders State Recreation Area, including the Special Use Area, takes in 5,350 acres—3,643 acres of land and 1,707 acres of water. There are 4 picnic sites, 100 camping sites, and 4 boat ramps. Recreation activities include swimming, waterskiing, fishing, picnicking, boating, tent and trailer camping, and hiking.

The Champion State Recreation Area and Champion Mill State Historical Park consist of an 11-acre pond and 2 acres of land. Activities are swimming, fishing, picnicking, rowing, sailing, and hunting. This area is also excellent for hiking, birdwatching, and photography. There are many large trees in the area, and the scenery is especially impressive in the spring and autumn.

The Wanamaker Special Use Area consists of 160 acres of land just north of Imperial. It offers hiking, birdwatching, and nature study.

The Champion water-powered mill at Champion, Nebraska, is classed as a state historical park and is a very scenic spot.

There are three nine-hole golf courses, one at Enders Lake operated by the Enders Lake Recreation Association, one operated by the Imperial Country Club, and one operated by the Wauneta Country Club.

Enders Reservoir and farm ponds throughout the county provide warm-water fishing.

Technical assistance in planning facilities for recreation within Chase County is available at the Soil Conservation Service field office in Imperial and at other federal or state agencies.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes

and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

Robert D. Koerner, biologist, Soil Conservation Service, helped to prepare this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and grain sorghum.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, smooth brome, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are big and little bluestem, indiangrass, switchgrass, goldenrod, beggarweed, western wheatgrass, and blue grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are bur oak, poplar, green ash, honeylocust, apple, hawthorn, dogwood, hickory, eastern cottonwood, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are sumac, autumn-olive, and American plum.

Coniferous plants furnish browse, seeds, and cones. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are skunkbush sumac, western snowberry, and coralberry.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, prairie cordgrass, rushes, sedges, and reedgrasses.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, skunk, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, red fox, coyote, raccoon, deer, and opossum.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, muskrat, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include antelope, deer, badger, prairie dog, prairie grouse, meadowlark, and lark bunting.

The relationship of the nine soil associations in Chase County and the kinds of wildlife they support is discussed in the following paragraphs.

The Valent association provides habitat predominantly for rangeland wildlife. Since the introduction of center pivot irrigation, much of the acreage has been used for corn. The cropland and especially the corners not reached by the sprinkler arms add to the diversity of plant cover and help support a wide variety of wildlife, for example, mule deer and, in limited numbers, pheasant, quail, jackrabbit, and prairie grouse.

There are prairie dog towns in some areas. Many prairie songbirds, such as meadowlark, horned lark, bobolink, and lark bunting, are common in areas of this association. Badger, skunk, and coyote are common along the main drainageways and in upland grassy areas. Hawks, owls, and eagles also inhabit areas of this association.

The Woodly-Jayem-Ascalon, Alliance-Mace-Kuma, and Kuma associations provide habitat for openland wildlife. Most of the acreage is cultivated; some is irrigated and is planted to corn, sugar beets, and field beans. The rest is dry-farmed and is mainly in a rotation of wheat and fallow. Trees are scattered along the drainageways and along fence rows. Many farmstead shelterbelts are planted to redcedar, Rocky Mountain juniper, ponderosa pine and Austrian pine, green ash, elm, honeylocust, Russian-olive, hackberry, plum, and chokecherry. Ring-necked pheasant, bobwhite quail, raccoon, skunk, badger, cottontail, jackrabbit, tree squirrels, songbirds, and birds of prey, such as hawks, owls, and eagles, inhabit areas of these associations.

The Rosebud-Canyon association also provides habitat for openland wildlife. Most of the acreage is irrigated by center pivot irrigation systems. Some areas are dry-farmed and are commonly in a rotation of wheat and fallow. The topography is gently rolling. Trees and shrubs are mainly around farmsteads or ranch headquarters. The common trees and shrubs are hackberry, ponderosa pine, redcedar and Rocky Mountain juniper, green ash, elm, honeylocust, Russian-olive, plum, and chokecherry. Proper grazing use is needed on much of the rangeland to increase the carrying capacity for livestock as well as for wildlife. Mule deer and white-tailed deer are the major kinds of wildlife. Prairie grouse, ring-necked pheasant, bobwhite quail, and grassland-associated birds, such as horned lark, meadowlark, lark bunting, and bobolink, also inhabit areas of this association.

The Colby and Otero-Canyon associations have strongly sloping to very steep topography. The areas support rangeland wildlife, mainly mule deer and white-tailed deer. The rough terrain also supports many small mammals—ground squirrels, prairie dogs, and pocket gophers—and their predators—hawks, owls, and eagles. It also supports raccoon, skunk, badger, coyote, and bobcat and reptiles, including the prairie rattlesnake. Some ring-necked pheasant and bobwhite quail also inhabit these areas.

The Gannett-Wann-Gibbon and Bridget-McCook associations offer the greatest diversity of habitat and support the largest number of wildlife species. The plant cover along major streams, such as Frenchman Creek, Stinking Water Creek, and Spring Creek, provides food and cover (fig. 17). Among the trees and shrubs that add to the diversity are cottonwoods, willow, boxelder, honeylocust, ash, elm, black walnut, hackberry, plum, chokecherry, and buckthorn. Grasses include big and

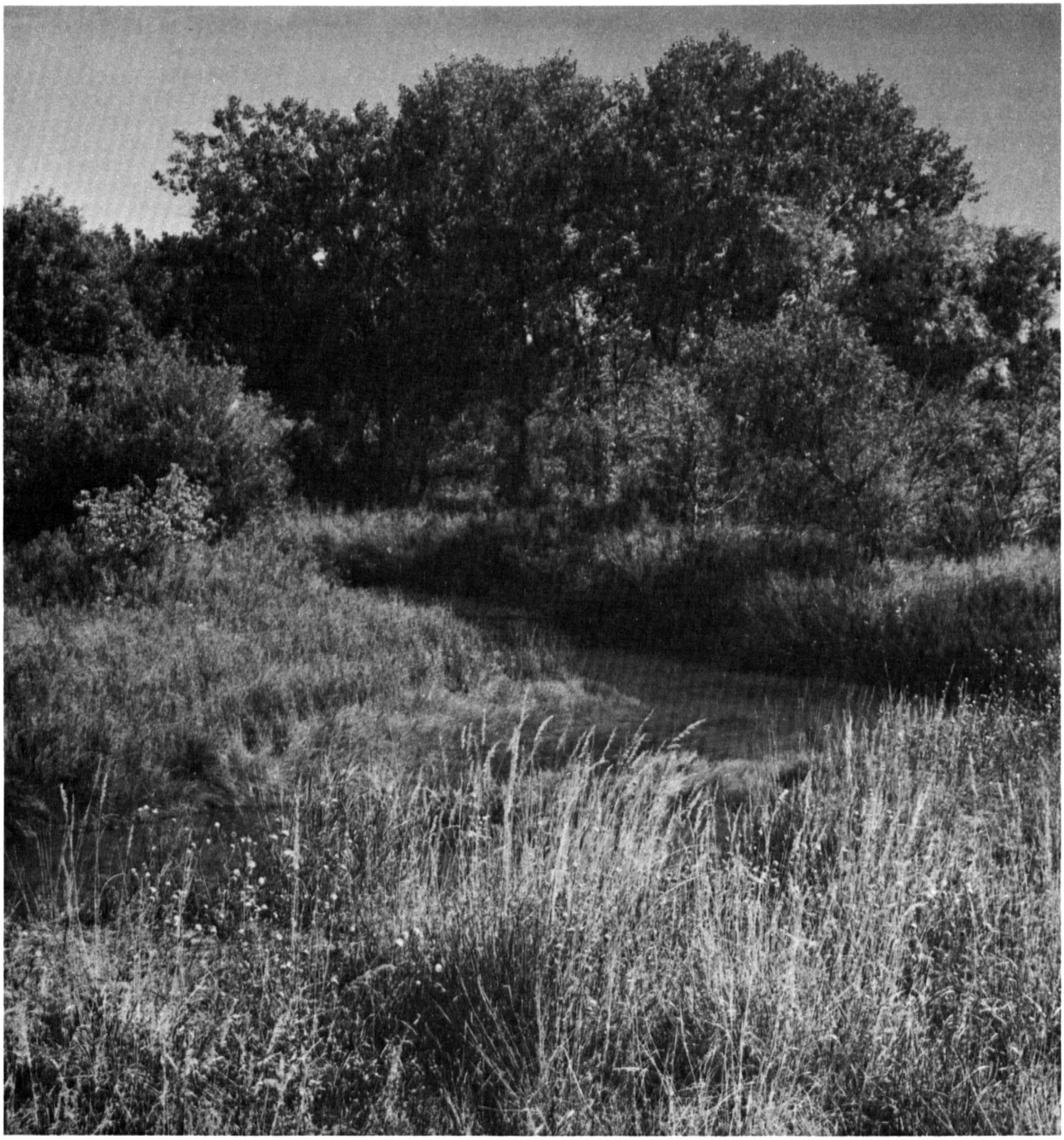

Figure 17.—Trees, shrubs, and grasses on Gannett silt loam, overwash, 0 to 2 percent slopes, along Frenchman Creek, provide excellent habitat for wildlife.

little bluestem, indiangrass, switchgrass, blue grama, buffalograss, prairie cordgrass, and reedgrass. Sedges, reeds, and cattails grow near or in water.

The kinds of wildlife in these associations include white-tailed deer and mule deer, opossum, raccoon, weasel, mink, muskrat, beaver, skunk, badger, coyote, bobcat, porcupine, cottontail rabbit, tree squirrels, pocket gophers, mice, songbirds, birds of prey such as hawks, owls, and eagles, ring-necked pheasant, bobwhite quail, herons, bitterns, and many shore birds such as avocets, phalaropes, sandpipers, and curlews.

Mourning doves are found throughout the county.

Technical assistance in designing installations to improve wildlife habitat in Chase County is available at the field office of the Soil Conservation Service in Imperial.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed

soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of

landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable

source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion,

an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 18.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69.

The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months;

November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

physical and chemical analyses of selected soils

Samples from soil profiles were collected for physical and chemical analysis by the Soil Conservation Service, Soil Survey Laboratory, in Lincoln, Nebraska. Soils of the Altvan, Canyon, Goshen, Keith, and Rosebud series were sampled in nearby counties in Nebraska. The data are recorded in Soil Survey Investigations Report Number 5 (*9*). Soils of the Haxtun, Keith, and Kuma series were sampled in a nearby county in Colorado. These data are recorded in Soil Survey Investigations Report Number 10 (*10*).

This information is helpful to soil scientists in classifying soils and developing concepts of soil genesis. It is also helpful in estimating the available water capacity of soils, susceptibility to soil blowing, fertility, tilth, and other practical aspects of soil management.

engineering index test data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and their

morphology." The soil samples were tested by the Nebraska Department of Roads.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Particle density, T 100-757 (AASHTO). The group index number that is part of the AASHTO classification is computed by using the Nebraska modified system.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*12*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning intermittently dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplustolls (*Hapl*, meaning minimal horizonation, plus *ustoll*, the suborder of the Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aridic*, for example, identifies the subgroup that receives less moisture than typifies the great group. An example is Aridic Haplustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Aridic Haplustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*8*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*12*). Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Alliance series

The Alliance series consists of deep, well drained, moderately slowly permeable soils on loess-covered uplands. The upper part of the solum formed in loess, and the lower part formed in material that weathered from weakly cemented caliche. Slope ranges from 0 to 1 percent.

Alliance soils are commonly adjacent to Ascalon, Kuma, Mace, and Rosebud soils. Ascalon soils are slightly higher on the landscape and have more sand in

the subsoil. Kuma soils have a mollic epipedon more than 20 inches thick and a buried horizon. Mace soils have bedrock at a depth of 20 to 40 inches. Rosebud soils have more sand in the subsoil and have bedrock at a depth of 20 to 40 inches.

Typical pedon of Alliance silt loam, 0 to 1 percent slopes, 2,400 feet north and 400 feet west of the southeast corner of sec. 19, T. 7 N., R. 41 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A12—5 to 9 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak medium granular; slightly hard, very friable; common very fine roots; neutral; clear smooth boundary.

B2t—9 to 17 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; common very fine roots; common worm casts; few thin discontinuous clay films on faces of peds; neutral; clear smooth boundary.

B3—17 to 24 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; numerous worm casts; mildly alkaline; gradual smooth boundary.

C—24 to 50 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; soft, very friable; few small white soft masses of carbonate; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—50 to 60 inches; white (10YR 8/2) calcareous, weakly cemented caliche; violent effervescence.

The solum is 16 to 30 inches thick. The depth to free carbonates ranges from 16 to 30 inches. The mollic epipedon is 12 to 20 inches thick. The depth to weakly cemented caliche ranges from 40 to 60 inches.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. Reaction is neutral or mildly alkaline. The B2t horizon has color value of 5 or 6 (3 through 5, moist) and chroma of 2 or 3. It is silt loam or silty clay loam and averages between 25 and 35 percent clay. Reaction is neutral or mildly alkaline. The B3 horizon has color value of 6 or 7 (4 through 6, moist) and chroma of 2 or 3. It is silt loam or very fine sandy loam. Reaction is neutral through moderately alkaline. The C horizon has color value of 6 through 8 (5 or 6, moist) and chroma of 2 or 3. It is very fine sandy loam, silt loam, fine sandy loam, or loamy very fine sand. Reaction is mildly or moderately alkaline. The Cr horizon has color value of 7 or 8 (6 or 7, moist) and chroma of 2 through 4.

Altvan series

The Altvan series consists of well drained soils on uplands. Permeability is moderate in the solum and very rapid in the underlying material. The soils formed in loamy material overlying sand or gravelly sand. Slopes range from 0 to 6 percent.

Altvan soils are commonly adjacent to Alliance, Ascalon, Canyon, and Rosebud soils. Alliance soils have less sand in the subsoil than Altvan soils. Alliance and Ascalon soils do not have sand or gravelly sand above a depth of 40 inches. Canyon soils are shallow, do not have a mollic epipedon, and are above Altvan soils on the landscape. Rosebud soils have bedrock at a depth of 20 to 40 inches.

Typical pedon of Altvan loam, 0 to 1 percent slopes, 2,000 feet south and 248 feet west of the northeast corner of sec. 6, T. 6 N., R. 40 W.

Ap—0 to 7 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; few very fine roots; few small pebbles; neutral; abrupt smooth boundary.

B21t—7 to 12 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; hard, firm; few very fine roots; thin patchy clay films on faces of peds; few small pebbles; mildly alkaline; clear smooth boundary.

B22t—12 to 21 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; thin patchy clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3—21 to 26 inches; pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common small pebbles; mildly alkaline; abrupt wavy boundary.

IIC—26 to 60 inches; pink (7.5YR 7/4) coarse sand, light brown (7.5YR 6/4) moist; single grain; loose; about 2 percent gravel; strong effervescence; strongly alkaline.

The thickness of the solum and the depth to free carbonates range from 16 to 28 inches. The mollic epipedon is 7 to 20 inches thick. The depth to sand or gravelly sand ranges from 20 to 40 inches. The solum is 0 to 15 percent gravel.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam. Reaction is slightly acid or

neutral. The Bt horizon has color value of 4 through 6 (3 or 4, moist) and chroma of 2 or 3. It is dominantly clay loam, but the range includes loam and sandy clay loam. On the average, it is 20 to 35 percent clay. Reaction ranges from neutral through moderately alkaline. The B3 horizon has color value of 6 or 7 (5 or 6, moist) and chroma of 2 or 3. It is dominantly loam, but the range includes silt loam. Reaction is mildly alkaline or moderately alkaline. Some pedons have a C horizon. Reaction ranges from mildly alkaline to strongly alkaline. The IIC horizon is dominantly sand, but the range includes gravelly coarse sand. Reaction ranges from mildly alkaline to strongly alkaline.

Ascalon series

The Ascalon series consists of deep, well drained, moderately permeable soils on uplands. The soils formed in loamy calcareous material. Slope ranges from 1 to 6 percent.

Ascalon soils are similar to Satanta soils and commonly are adjacent to Alliance, Haxtun, Jayem, Rosebud, and Woodly soils. Satanta soils have a subsoil that averages less than 35 percent fine and coarser sand. Alliance soils have less sand in the subsoil and are in lower positions than Ascalon soils. Haxtun and Woodly soils have a mollic epipedon more than 20 inches thick. They are below Ascalon soils on the landscape. Jayem soils are sandier throughout than Ascalon soils. Rosebud soils are in lower positions and have bedrock at a depth of 20 to 40 inches.

Typical pedon of Ascalon fine sandy loam, 1 to 3 percent slopes, 650 feet west and 825 feet north of the southeast corner of sec. 23, T. 8 N., R. 39 W.

A1—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; few very fine roots; neutral; clear smooth boundary.

B1—6 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, very friable; few very fine roots; neutral; clear smooth boundary.

B21t—10 to 17 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few very fine roots; few very thin patchy clay films; neutral; clear smooth boundary.

B22t—17 to 22 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate subangular blocky; hard, friable; neutral; clear smooth boundary.

B3—22 to 28 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak medium prismatic structure; slightly hard, very friable; mildly alkaline; gradual smooth boundary.

Cca—28 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable; many myceliumlike threads and filaments of carbonate; few small white masses of carbonate; violent effervescence; moderately alkaline.

The solum is 15 to 30 inches thick. The depth to free carbonates ranges from 15 to 30 inches. The mollic epipedon is 7 to 20 inches thick.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam. The B2t horizon has color value of 5 or 6 (3 or 4, moist) and chroma of 2 through 4. It is sandy clay loam. Reaction is neutral or mildly alkaline. The C horizon has color value of 6 through 8 (5 through 6, moist) and chroma of 2 through 4. It generally is very fine sandy loam, but the range includes fine sandy loam, sandy loam, and loamy fine sand.

Blanche series

The Blanche series consists of moderately deep, well drained, moderately rapidly permeable soils on uplands. The soils formed in calcareous material that weathered from weakly cemented caliche. Slope ranges from 0 to 3 percent.

Blanche soils commonly are adjacent to Canyon, Jayem, Rosebud, Valent, and Woodly soils. Canyon soils are shallow and are on ridges and knolls above the Blanche soils. Jayem soils are deep and are in similar positions on the landscape. Rosebud soils have more clay in the subsoil and are in similar positions on the landscape. Valent soils are deep, are sandy throughout, and are on hummocky sandhills above the Blanche soils. Woodly soils are deep, have more clay in the subsoil, and are in undulating areas above the Blanche soils.

Typical pedon of Blanche very fine sandy loam, 0 to 3 percent slopes, 1,450 feet west and 516 feet south of the northeast corner of sec. 6, T. 8 N., R. 39 W.

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, very friable; common very fine and few fine roots; mildly alkaline; abrupt smooth boundary.

A12—6 to 11 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, very friable; common very fine and few fine roots; mildly alkaline; clear smooth boundary.

B21—11 to 19 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, very friable; few very fine and fine roots; common very fine tubular pores; mildly alkaline; clear smooth boundary.

B22—19 to 26 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable; few fine roots; common very fine tubular pores; common worm channels about 2 to 4 millimeters in diameter; mildly alkaline; clear smooth boundary.

B3ca—26 to 34 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; common fine roots; few very fine tubular pores; many myceliumlike threads of calcium carbonate; many chips and fragments of caliche; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—34 to 60 inches; white (10YR 8/2) weakly cemented caliche, light gray (10YR 7/2) moist; violent effervescence; moderately alkaline.

The solum is 17 to 39 inches thick. The depth to free carbonates ranges from 14 to 30 inches. The mollic epipedon is 7 to 20 inches thick. Horizons that have color value of less than 5.5 dry and 3.5 moist extend to a depth of 20 to 32 inches, but the organic carbon content is less than 0.6 percent at a depth of more than 20 inches. The depth to weakly cemented caliche ranges from 20 to 40 inches.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2. It is dominantly very fine sandy loam, but the range includes fine sandy loam and loamy fine sand. Reaction is neutral or mildly alkaline. The B2 horizon has color value of 4 through 6 (2 through 4, moist) and chroma of 1 through 3. It is dominantly fine sandy loam, but the range includes very fine sandy loam or loam. Reaction is neutral through moderately alkaline. The B3ca horizon has color value of 5 through 7 (4 through 6, moist) and chroma of 1 though 3. It is dominantly fine sandy loam, but the range includes very fine sandy loam, loam, and loamy fine sand. Reaction is mildly alkaline or moderately alkaline. Some pedons have a C horizon.

Bridget series

The Bridget series consists of deep, well drained, moderately permeable soils on stream terraces and foot slopes. The soils formed in silty and loamy, calcareous colluvial-alluvial sediment. Slope ranges from 0 to 3 percent.

Bridget soils commonly are adjacent to Colby, McCook, and Ulysses soils. Unlike Bridget soils, Colby soils do not have a mollic epipedon, and they are on steeper slopes above the Bridget soils. McCook soils have stratified layers throughout and are on bottom lands below the Bridget soils. Ulysses soils have more clay in the subsoil and are in more sloping areas above the Bridget soils.

Typical pedon of Bridget silt loam, 1 to 3 percent slopes, 1,400 feet south and 50 feet east of the northwest corner of sec. 10, T. 5 N., R. 36 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable; few very fine and fine roots; neutral; abrupt smooth boundary.

A12—5 to 12 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, friable; few very fine roots; neutral; clear smooth boundary.

AC—12 to 21 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few very fine roots; few very fine and fine pores; few worm channels 2 to 5 millimeters in diameter; violent effervescence; moderately alkaline; gradual smooth boundary.

C—21 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; few very fine pores; few myceliumlike threads and filaments of lime; violent effervescence; moderately alkaline.

The solum is 10 to 28 inches thick. The mollic epipedon is 8 to 18 inches thick. The depth to free carbonates ranges from 0 to 15 inches.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. It is typically silt loam and less commonly loam or very fine sandy loam. Reaction is neutral or mildly alkaline. The AC horizon has color value of 5 through 7 (4 or 5, moist) and chroma of 2 or 3. It is typically silt loam and less commonly loam or very fine sandy loam averaging between 10 and 18 percent clay. Reaction is mildly alkaline or moderately alkaline. The C horizon has color value of 6 through 8 (4 through 6, moist) and chroma of 2 through 4. It is typically silt loam or very fine sandy loam. Less commonly, it is loam. Reaction is mildly alkaline or moderately alkaline.

Bushman series

The Bushman series consists of deep, well drained, moderately rapidly permeable soils on foot slopes and stream terraces. The soils formed in calcareous, loamy

colluvial-alluvial material. Slope ranges from 1 to 4 percent.

Bushman soils are commonly adjacent to Canyon, Caruso, Gibbon, Otero, and Wann soils. Canyon soils do not have a mollic epipedon and are shallow. Canyon soils are above Bushman soils on the landscape. Caruso soils have more clay and are stratified, and they are somewhat poorly drained. They are at a lower elevation than Bushman soils. Gibbon soils have more silt and are stratified, and they are somewhat poorly drained. They are below Bushman soils on the landscape. Otero soils do not have a mollic epipedon and are at a higher elevation. Wann soils are somewhat poorly drained and are at a lower elevation.

Typical pedon of Bushman very fine sandy loam, 1 to 4 percent slopes, 2,000 feet south and 90 feet east of the northwest corner of sec. 13, T. 7 N., R. 38 W.

A11—0 to 7 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very dark brown (10YR 2/2) moist; moderate medium granular structure; slightly hard, very friable; common very fine roots; few limestone chips and fragments; about 3 percent gravel, by volume; strong effervescence; mildly alkaline; clear smooth boundary.

A12—7 to 13 inches; dark grayish brown (10YR 4/2) very fine sandy loam, very dark brown (10YR 2/2) moist; moderate medium subangular blocky structure; slightly hard, very friable; common very fine roots; few limestone chips and fragments; about 3 percent gravel, by volume; violent effervescence; moderately alkaline; clear smooth boundary.

AC—13 to 24 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, very friable; few very fine roots; many limestone chips and fragments; about 1 percent large pebbles, by volume; violent effervescence; moderately alkaline; gradual smooth boundary.

C—24 to 60 inches; pale brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) moist; massive; soft, very friable; few very fine roots in the upper 10 inches; numerous limestone chips and fragments; few large pebbles; violent effervescence; moderately alkaline.

The solum is 15 to 30 inches thick. The depth to carbonates ranges from 0 to 7 inches. The mollic epipedon is 7 to 20 inches thick.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes fine sandy loam. The AC horizon has value of 5 or 6 (3 or 4, moist) and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes fine sandy loam. The C horizon has value of 6 or 7 (4 through 6, moist) and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes fine sandy loam.

Canyon series

The Canyon series consists of shallow, well drained, moderately permeable soils on uplands. The soils formed in calcareous, loamy material that weathered from weakly cemented caliche. Slope ranges from 0 to 45 percent.

Canyon soils are similar to Tassel soils and are commonly adjacent to Duda, Mace, Otero, and Rosebud soils. Tassel soils are less than 10 percent clay above the bedrock. Duda soils are moderately deep and are sandier than Canyon soils. Mace and Rosebud soils are in a lower position than Canyon soils; they have a mollic epipedon and are 20 to 40 inches deep to bedrock. Otero soils are deep and are below Canyon soils on the landscape.

Typical pedon of Canyon loam (fig. 18), in an area of

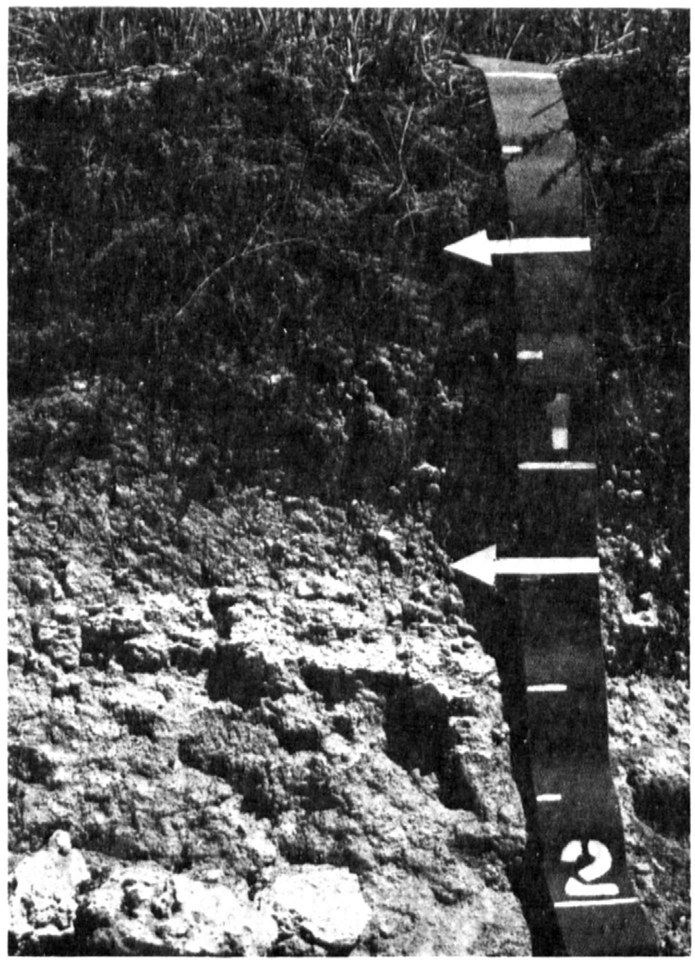

Figure 18.—Profile of Canyon silt loam, in an area of Otero-Canyon loams, 6 to 20 percent slopes. The lower marker indicates the top of the weakly cemented caliche. Depth is marked in feet.

Otero-Canyon loams, 6 to 20 percent slopes, 600 feet west of the southeast corner of sec. 14, T. 7 N., R. 38 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable; many very fine roots; about 5 percent limestone chips and fragments 1 to 15 millimeters in diameter; strong effervescence; mildly alkaline; abrupt smooth boundary.

AC—4 to 10 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; common very fine roots; violent effervescence; moderately alkaline; clear smooth boundary.

C—10 to 17 inches; light gray (10YR 7/2) loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable; few very fine roots; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—17 to 60 inches; white (10YR 8/1) weakly cemented caliche; violent effervescence.

The solum is 6 to 12 inches thick. The depth to bedrock ranges from 6 to 20 inches. The depth to free carbonates ranges from 0 to 6 inches.

The A horizon has color value of 4 through 7 (3 through 6, moist) and chroma of 2 or 3. It is silt loam, loam, fine sandy loam, or gravelly loam. Reaction is mildly alkaline or moderately alkaline. The AC horizon has color value of 5 through 8 (4 through 7, moist) and chroma of 2 or 4. It is loam, very fine sandy loam, or gravelly loam. Reaction is mildly alkaline or moderately alkaline. In some places, there is no AC horizon. The C horizon has color value of 6 through 8 (4 through 7, moist) and chroma of 2 or 4. It is loam, very fine sandy loam, or gravelly loam. Reaction is mildly alkaline or moderately alkaline.

Caruso series

The Caruso series consists of deep, somewhat poorly drained, moderately permeable soils on bottom lands. The soils formed in calcareous, stratified loamy alluvium. Slope ranges from 0 to 2 percent.

Caruso soils are commonly adjacent to Bushman, Gannett, and Gibbon soils. Bushman soils have more sand throughout and are above the Caruso soils on the landscape. Gannett soils are very poorly drained and are in slightly lower positions on the landscape. Gibbon soils have less clay and are on the same landscape as Caruso soils.

Typical pedon of Caruso loam, 0 to 2 percent slopes, 1,900 feet north and 650 feet west of the southeast corner of sec. 16, T. 6 N., R. 39 W.

A11—0 to 6 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, friable; many very fine root; violent effervescence; strongly alkaline; clear smooth boundary.

A12—6 to 12 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, friable; common very fine roots; violent effervescence; strongly alkaline; clear smooth boundary.

C1—12 to 23 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, friable; few very fine roots; violent effervescence; moderately alkaline; abrupt wavy boundary.

C2—23 to 33 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable; few very fine roots; few thin dark grayish brown (10YR 4/2, moist) strata; violent effervescence; strongly alkaline; clear smooth boundary.

C3—33 to 60 inches; light gray (10YR 7/2) loam, grayish brown (10YR 5/2) moist; common fine distinct light olive brown (2.5Y 5/4, moist) mottles; massive; slightly hard, friable; many soft masses of calcium carbonate 3 to 10 millimeters in diameter; violent effervescence; strongly alkaline.

The solum and the mollic epipedon are 7 to 20 inches thick. The depth to free carbonates ranges from 0 to 10 inches.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2. It is dominantly loam, but the range includes sandy loam and silt loam. The C horizon has value of 5 through 7 (3 through 5, moist) and chroma of 1 through 3. Reaction is mildly alkaline to strongly alkaline throughout.

Colby series

The Colby series consists of deep, well drained and somewhat excessively drained, moderately permeable soils on uplands. The soils formed in silty, calcareous loess loam. Slope ranges from 6 to 60 percent.

Colby soils commonly are adjacent on the landscape to Canyon and Ulysses soils. Canyon soils are sandier throughout than Colby soils and have bedrock at a depth of 6 to 20 inches. Ulysses soils have a mollic epipedon and generally have more clay in the subsoil.

Typical pedon of Colby silt loam, 30 to 60 percent slopes, 1,155 feet east and 175 feet south of the northwest corner of sec. 13, T. 6 N., R. 37 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; few fine roots; slight effervescence; mildly alkaline; clear smooth boundary.
AC—4 to 10 inches; light brownish gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) moist; weak medium granular structure; soft, very friable; common fine roots; violent effervescence; moderately alkaline; gradual smooth boundary.
C1ca—10 to 20 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; few fine roots and root channels; common very fine pores; many myceliumlike filaments and threads of lime on surface of peds; violent effervescence; moderately alkaline; gradual wavy boundary.
C2—20 to 60 inches; very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The solum is 5 to 12 inches thick. The depth to carbonates ranges from 0 to 6 inches.

The A horizon has color value of 5 through 7 (3 through 5, moist) and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam and very fine sandy loam. Reaction is mildly alkaline or moderately alkaline. The C horizon has color value of 5 through 7 (4 through 6, moist) and chroma of 2 through 4. It is silt loam or loam. Reaction is mildly alkaline or moderately alkaline.

Creighton series

The Creighton series consists of deep, well drained, moderately permeable soils on high terraces and uplands. The soils formed in loamy calcareous material. Slopes range from 0 to 11 percent.

Creighton soils are similar to Jayem soils and are commonly adjacent to Ascalon and Rosebud soils. Jayem soils are noncalcareous throughout. Ascalon soils have more clay in the subsoil and are on similar landscapes. Rosebud soils have bedrock at a depth of 20 to 40 inches and have more clay in the subsoil.

Typical pedon of Creighton very fine sandy loam, 1 to 3 percent slopes, 2,540 feet west and 500 feet north of the southeast corner of sec. 28, T. 6 N., R. 37 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.
A12—5 to 12 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, very friable; neutral; clear smooth boundary.
B2—12 to 20 inches; brown (10YR 5/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; neutral; clear smooth boundary.
C1ca—20 to 27 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; many small white soft masses of calcium carbonate; few myceliumlike threads and filaments of calcium carbonate; violent effervescence; moderately alkaline; gradual wavy boundary.
C2ca—27 to 60 inches; white (10YR 8/2) very fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable; many small white soft masses of calcium carbonate; violent effervescence; moderately alkaline.

The solum is 16 to 30 inches thick. The depth to free carbonates ranges from 6 to 20 inches. The mollic epipedon is 7 to 15 inches thick.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. Reaction is slightly acid to mildly alkaline. The B2 horizon has color value of 5 through 7 dry (4 through 6, moist) and chroma of 2 through 6. It is neutral or mildly alkaline. Weakly cemented caliche is below a depth of 60 inches in some places.

Dailey series

The Dailey series consists of deep, somewhat excessively drained, rapidly permeable soils that formed in eolian sand in upland valleys. Slopes range from 0 to 3 percent.

Dailey soils are similar to Valent soils and commonly are adjacent to Haxtun, Jayem, and Vetal soils. Valent soils do not have a mollic epipedon and are higher on the landscape. Haxtun soils have more clay in the subsoil and have a mollic epipedon more than 20 inches thick. Jayem soils have more clay throughout. Vetal soils have more clay throughout and have a mollic epipedon more than 20 inches thick.

Typical pedon of Dailey loamy sand, 0 to 3 percent slopes, 1,320 feet west and 750 feet south of the northeast corner of sec. 36, T. 8 N., R. 40 W.

A1—0 to 14 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; many very fine roots; neutral; gradual wavy boundary.
C—14 to 60 inches; light yellowish brown (10YR 6/4) loamy sand, yellowish brown (10YR 5/4) moist; single grain; loose; few very fine roots; neutral.

The solum is 10 to 20 inches thick. The mollic epipedon is 10 to 20 inches thick.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. It is dominantly loamy sand, but

the range includes loamy fine sand and fine sand. The C horizon has color value of 6 or 7 (4 or 5, moist) and chroma of 2 through 4. It is dominantly loamy sand, but the range includes fine sand and loamy fine sand. Reaction is neutral or mildly alkaline to a depth of 40 inches or more.

Duda series

The Duda series consists of moderately deep, well drained, rapidly permeable soils on uplands. The soils formed in eolian sand over calcareous, weakly cemented caliche. Slope ranges from 0 to 15 percent.

Duda soils in Chase County are in a drier climate than that defined as the range for the Duda series, and they formed over weakly cemented caliche. These differences, however, do not affect the use or behavior of these soils.

Duda soils commonly are adjacent on the landscape to Dailey, Rosebud, Tassel, and Valent soils. Dailey soils are deep, have a mollic epipedon, and are in lower positions than Duda soils. Rosebud soils have more clay throughout and have a mollic epipedon. Rosebud soils are in slightly lower positions than Duda soils. Tassel soils have bedrock at a depth of 10 to 20 inches. Tassel soils are in lower positions than Duda soils. Valent soils are deep and in higher positions.

Typical pedon of Duda loamy sand, in an area of Duda-Tassel loamy sands, 3 to 6 percent slopes, 2,310 feet north and 330 feet east of the southwest corner of sec. 6, T. 8 N., R. 39 W.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) loamy sand, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; common very fine and fine roots; neutral; gradual smooth boundary.

AC—7 to 14 inches; brown (10YR 5/3) loamy fine sand, brown (10YR 4/3) moist; weak coarse prismatic structure; loose; common very fine and fine roots; neutral; gradual smooth boundary.

C1—14 to 28 inches; brown (10YR 5/3) fine sand, brown (10YR 4/3) moist; single grain; loose; numerous small, medium, and large sandstone chips and fragments between depths of 24 and 28 inches; neutral; gradual wavy boundary.

IICr—28 to 60 inches; white (10YR 8/2) weakly cemented caliche; violent effervescence.

The solum is 12 to 20 inches thick. The depth to bedrock ranges from 20 to 40 inches. Carbonates are leached down to bedrock.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. It is dominantly loamy sand, but the range includes loamy fine sand and fine sand. It is slightly acid or neutral. The AC horizon has color value of 5 or 6 (4 or 5, moist) and chroma of 2 or 3. It is dominantly loamy fine sand, but the range includes loamy sand. It is slightly acid or neutral. The C horizon has color value of 5 through 7 (4 through 6, moist) and chroma of 2 through 4. It is dominantly fine sand, but the range includes loamy fine sand and loamy sand. Reaction ranges from slightly acid to mildly alkaline.

Gannett series

The Gannett series consists of deep, very poorly drained, moderately permeable soils on bottom lands. These soils formed in silty, calcareous alluvium. Slope ranges from 0 to 2 percent.

Gannett soils in Chase County have less sand than that defined as the range for the Gannett series. This difference, however, does not affect the use and behavior of these soils.

Gannett soils are adjacent to Fluvaquents and to Gibbon and Wann soils. Fluvaquents are in very poorly drained depressions that generally contain 3 to 12 inches of water. Gibbon soils are somewhat poorly drained and are slightly higher on the landscape than Gannett soils. Wann soils are somewhat poorly drained and are at a higher elevation.

Typical pedon of Gannett silt loam, overwash, 0 to 2 percent slopes, 2,275 feet east and 950 feet south of the northwest corner of sec. 19, T. 7 N., R. 37 W.

A11—0 to 4 inches; light gray (10YR 7/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; common very fine and medium roots; violent effervescence; moderately alkaline; clear smooth boundary.

C1—4 to 11 inches; gray (10YR 6/1) silt loam, very dark gray (10YR 3/1) moist; common fine faint yellowish brown (10YR 5/4, moist) mottles; weak fine subangular blocky structure; soft, friable; common very fine and fine roots; violent effervescence; moderately alkaline; clear smooth boundary.

A12—11 to 30 inches; dark gray (2.5Y N4/0) silt loam, black (2.5Y N2/0) moist; massive; slightly hard, friable; common very fine and fine roots; mildly alkaline; abrupt wavy boundary.

A13—30 to 50 inches; dark gray (10YR 4/1) very fine sandy loam, black (2.5Y N2/0) moist; massive; slightly hard, friable; common very fine and fine roots; mildly alkaline; abrupt wavy boundary.

C2—50 to 60 inches; stratified dark gray (10YR 4/1), gray (10YR 6/1), and light gray (10YR 7/2) very fine sandy loam, very dark gray (10YR 3/1), gray (10YR 5/1), and grayish brown (10YR 5/2) moist; massive; soft, very friable; mildly alkaline.

The overwash is 7 to 20 inches thick. The buried mollic epipedon is 7 to 40 inches thick. Reaction is mildly or moderately alkaline.

The A11 horizon has hue of 10YR or 2.5Y, value of 3 through 7 (2 or 3, moist), and chroma of 1 or 2. It is typically silt loam, but the range includes very fine sandy

loam. The A12 horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3, moist), and chroma of 0 or 1. It is silt loam or very fine sandy loam. The C horizon has hue of 10YR, 2.5Y or 5Y, value of 4 through 7 (2 through 5, moist), and chroma of 1 or 2. It is silt loam or very fine sandy loam.

Gibbon series

The Gibbon series consists of deep, somewhat poorly drained, moderately permeable soils on bottom lands. The soils formed in silty and loamy, calcareous alluvium. Slope ranges from 0 to 2 percent.

Gibbon soils in Chase County have less clay than that defined as the range for the Gibbon series. This difference, however, does not affect the use and behavior of the soils.

Gibbon soils are commonly adjacent to Fluvaquents and to Bridget, Gannett, McCook, and Wann soils. Bridget soils are well drained and are above Gibbon soils on the landscape. Fluvaquents are very poorly drained, are usually covered with water, amd are below Gibbon soils. Gannett soils are very poorly drained and are ponded in places. They are below Gibbon soils. McCook soils are well drained and moderately well drained and are above Gibbon soils. Wann soils have less silt throughout than Gibbon soils.

Typical pedon of Gibbon silt loam, 0 to 2 percent slopes, 1,700 feet south and 125 feet east of the northwest corner of sec. 25, T. 7 N., R. 36 W.

A1—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very dark gray (10YR 3/1) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, friable; common fine and medium roots; common fine and medium tubular pores; strong effervescence; moderately alkaline; abrupt smooth boundary.

AC—9 to 15 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; few fine faint yellow (10YR 7/6, moist) mottles; weak medium subangular blocky structure parting to weak fine subangular blocky; soft, very friable; few fine and medium roots; common fine tubular pores; violent effervescence; moderately alkaline; clear smooth boundary.

C1—15 to 27 inches; light gray (10YR 7/1) very fine sandy loam, grayish brown (2.5Y 5/2) moist; common fine faint yellowish brown (10YR 5/6, moist) mottles; massive; slightly hard, very friable; few fine tubular pores; few small iron and manganese concretions; violent effervescence; moderately alkaline; abrupt smooth boundary.

C2—27 to 37 inches; grayish brown (10YR 5/2) silt loam, very dark gray (10YR 3/1) moist; common fine distinct reddish brown (5YR 5/4, moist) mottles; massive; slightly hard, very friable; few fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

C3—37 to 60 inches; white (10YR 8/2) very fine sandy loam, grayish brown (10YR 5/2) moist; common medium faint yellowish brown (10YR 5/6, moist) mottles; massive; soft, very friable; few fine roots; violent effervescence; moderately alkaline.

The solum is 12 to 28 inches thick. The mollic epipedon is 7 to 15 inches thick. The depth to carbonates ranges from 0 to 10 inches.

The A horizon has color value of 3 through 5 (2 or 3, moist) and chroma of 1 or 2. It is typically silt loam, but the range includes loam and very fine sandy loam. The C horizon has hue of 10YR or 2.5Y, value of 5 through 8 (4 through 6, moist), and chroma of 1 or 2. It is typically silt loam or very fine sandy loam, but the range includes fine sandy loam and loam. In places, some pedons have thin strata of loamy fine sand, loamy sand, or fine sand below a depth of 40 inches.

Goshen series

The Goshen series consists of deep, well drained, moderately permeable soils on loess-covered uplands. Slope ranges from 0 to 1 percent.

Goshen soils are similar to Kuma soils and commonly are adjacent to Alliance, Kuma, Mace, and Scott soils. Kuma soils have a buried horizon. Alliance soils have a mollic epipedon less than 20 inches thick and have bedrock at a depth of 40 to 60 inches. Mace soils have a mollic epipedon less than 20 inches thick and have bedrock at a depth of 20 to 40 inches. Scott soils have more clay in the subsoil and are in shallow depressions.

Typical pedon of Goshen silt loam, 0 to 1 percent slopes, 2,112 feet east and 1,320 feet south of the northwest corner of sec. 36, T. 5 N., R. 39 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

A12—5 to 10 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak fine granular; soft, very friable; neutral; clear smooth boundary.

B21t—10 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; few fine roots; common very fine tubular pores; few shiny surfaces on peds; many worm casts and channels 3 to 8 millimeters in diameter; neutral; clear smooth boundary.

B22t—18 to 25 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse prismatic structure parting to moderate medium and fine subangular blocky; slightly hard, friable; common very fine roots; common very fine tubular pores; few shiny surfaces on peds; many worm casts and channels 3 to 8 millimeters in diameter; mildly alkaline; clear smooth boundary.

B23t—25 to 32 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium and coarse subangular blocky structure; slightly hard, friable; common very fine roots; common very fine tubular pores; many worm casts and channels 3 to 8 millimeters in diameter and filled with pale brown (10YR 6/3) material; slight effervescence; moderately alkaline; clear smooth boundary.

B3ca—32 to 36 inches; light brownish gray (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse subangular blocky structure; slightly hard, friable; common very fine tubular pores; many white myceliumlike threads and filaments of calcium carbonate; many worm casts and channels 3 to 8 millimeters in diameter filled with very pale brown (10YR 7/3) material; violent effervescence; moderately alkaline; clear smooth boundary.

C1ca—36 to 48 inches; light gray (10YR 7/2) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable; many white myceliumlike threads and filaments of calcium carbonate; violent effervescence; moderately alkaline; clear smooth boundary.

C2—48 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The solum is 32 to 46 inches thick. The mollic epipedon is 24 to 32 inches thick. The depth to free carbonates ranges from 25 to 36 inches.

The A horizon has color value of 3 through 5 (2 or 3, moist) and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam. Reaction is neutral or mildly alkaline. The upper part of the B2t horizon has color value of 3 through 5 (2 through 3, moist) and chroma of 2 or 3. It is dominantly silty clay loam, but the range includes silt loam and loam. The lower part of the B2t horizon has color value of 5 or 6 (3 through 5, moist) and chroma of 2 or 3. Reaction in the B2t horizon ranges from neutral through moderately alkaline. The B3 horizon is silt loam or very fine sandy loam. The C horizon has color value of 6 or 7 (4 through 6, moist) and chroma of 2 or 3. It is silt loam or very fine sandy loam. Reaction is moderately alkaline with strong or violent effervescence. In some places, weakly cemented limestone is at a depth of 40 to 60 inches.

Haxtun series

The Haxtun series consists of deep, well drained, moderately permeable soils in upland valleys. The soils formed in loamy and sandy eolian material that overlies an old buried soil. Slope ranges from 0 to 3 percent.

Haxtun soils are similar to Woodly soils and are commonly adjacent to Jayem, Rosebud, Valent, and Vetal soils. All these soils, unlike Haxtun soils, do not have a buried soil. Jayem soils have a mollic epipedon less than 20 inches thick and are sandier throughout than Haxtun soils. Rosebud soils have a mollic epipedon less than 20 inches thick and have bedrock at a depth of 20 to 40 inches. Valent soils are sandy throughout and do not have a mollic epipedon. Valent soils are in higher positions than Haxtun soils. Vetal soils are sandier throughout and are on a landscape similar to that of Haxtun soils.

Typical pedon of Haxtun fine sandy loam, 0 to 3 percent slopes, 1,350 feet north and 175 feet east of the southwest corner of sec. 10, T. 8 N., R. 38 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; few very fine roots; neutral; abrupt smooth boundary.

A12—5 to 11 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse subangular blocky structure parting to weak medium granular; slightly hard, very friable; few very fine roots; neutral; clear smooth boundary.

B21t—11 to 18 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, friable; few very fine roots; few shiny surfaces on peds; neutral; clear smooth boundary.

B22tb—18 to 31 inches; dark grayish brown (10YR 4/2) loam, black (10YR 2/1) moist; moderate medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few very fine roots; few very fine tubular pores; many worm casts and channels 3 to 8 millimeters in diameter; few shiny surfaces on peds; neutral; abrupt smooth boundary.

B23tcab—31 to 36 inches; dark grayish brown (10YR 4/2) loam, very dark gray (10YR 3/1) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few very fine roots; few very fine tubular pores; many coatings of calcium carbonate on faces of peds; many myceliumlike threads and filaments of calcium carbonate; many worm casts and channels 3 to 8 millimeters in diameter filled with very pale brown (10YR 7/3) material; few shiny surfaces on peds; violent effervescence; moderately alkaline; clear smooth boundary.

B3cab—36 to 50 inches; pale brown (10YR 6/3) very fine sandy loam, grayish brown (10YR 5/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few very fine tubular pores; many coatings of calcium carbonate on faces of peds; many threads and filaments of calcium carbonate; many worm casts and channels 3 to 8 millimeters in diameter; violent effervescence; moderately alkaline; clear smooth boundary.

C—50 to 60 inches; light yellowish brown (10YR 6/4) loamy very fine sand, brown (10YR 5/3) moist; massive; soft, very friable; mildly alkaline.

The solum is 31 to 56 inches thick. The mollic epipedon is 25 to 48 inches thick.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. It is dominantly fine sandy loam, but the range includes sandy loam and loamy fine sand. Reaction is neutral or mildly alkaline. The B2t horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2. It is loam, sandy clay loam, or clay loam. Reaction is neutral to moderately alkaline. The C horizon has color value of 6 or 7 (5 or 6, moist) and chroma of 2 through 4. Reaction is mildly alkaline or moderately alkaline.

Jayem series

The Jayem series consists of deep, well drained, moderately rapidly permeable soils on uplands. The soils formed in loamy and sandy eolian material. Slopes range from 0 to 6 percent.

Jayem soils are similar to Vetal soils and are commonly adjacent to Creighton, Haxtun, Valent and Woodly soils. Vetal soils have a mollic epipedon more than 20 inches thick. Creighton soils formed in calcareous material. Haxtun and Woodly soils have more clay throughout and have a mollic epipedon more than 20 inches thick. Valent soils are sandier throughout, do not have a mollic epipedon, and are at a higher elevation than Jayem soils.

Typical pedon of Jayem fine sandy loam, 0 to 3 percent slopes, 300 feet west and 100 feet north of the southeast corner of sec. 32, T. 8 N., R. 39 W.

A1—0 to 11 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; common very fine roots; neutral; clear smooth boundary.

B2—11 to 21 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few very fine roots; mildly alkaline; gradual smooth boundary.

C1—21 to 42 inches; yellowish brown (10YR 5/4) fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; few very fine roots; mildly alkaline; gradual smooth boundary.

C2—42 to 60 inches; light yellowish brown (10YR 6/4) loamy fine sand, brown (10YR 5/3) moist; massive; loose; mildly alkaline.

The solum is 15 to 32 inches thick. The mollic epipedon is 7 to 20 inches thick.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. It is fine sandy loam or loamy fine sand. Reaction is neutral or mildly alkaline. The B horizon has color value of 5 or 6 (4 or 5, moist) and chroma of 2 through 4. It is fine sandy loam or very fine sandy loam. Reaction is neutral or mildly alkaline. The C horizon has color value of 5 through 7 (4 through 6, moist) and chroma of 2 through 4. It is dominantly fine sandy loam or very fine sandy loam to a depth of 40 inches. Below that, it is fine sandy loam, sandy loam, very fine sandy loam, loamy very fine sand, or loamy fine sand.

Keith series

The Keith series consists of deep, well drained, moderately permeable soils on uplands. The soils formed in silty loess. Slope ranges from 1 to 6 percent.

Keith soils are similar to Alliance soils and commonly are adjacent to Goshen, Kuma, and Ulysses soils. Alliance soils have bedrock at a depth of 40 to 60 inches. Goshen soils have a mollic epipedon more than 20 inches thick and are at a lower elevation than Keith soils. Kuma soils have a mollic epipedon more than 20 inches thick, and unlike Keith soils they have a buried soil. Kuma soils are below Keith soils on the landscape. Ulysses soils are higher on the landscape than Keith soils.

Typical pedon of Keith silt loam, 1 to 3 percent slopes, 1,100 feet east and 600 feet north of the southwest corner of sec. 31, T. 5 N., R. 36 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

B2t—6 to 16 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; many thin discontinuous clay films on faces of peds; neutral; clear smooth boundary.

B3ca—16 to 23 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable; many myceliumlike filaments and threads of calcium carbonate; few coatings of calcium carbonate on faces of peds; violent effervescence; moderately alkaline; gradual smooth boundary.

Cca—23 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; common soft white accumulations of lime; many myceliumlike filaments and threads of calcium carbonate; violent effervescence; moderately alkaline.

The solum is 16 to 36 inches thick. The mollic epipedon is 8 to 20 inches thick. The depth to free carbonates ranges from 14 to 33 inches.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam. Reaction is slightly acid or neutral. The B2t horizon has color value of 4 or 5 (2 through 4, moist) and chroma of 2 or 3. It is dominantly silty clay loam, but the range includes silt loam, clay loam, and loam. It averages between 25 and 33 percent clay. Reaction is neutral or mildly alkaline. The C horizon has color value of 6 through 8 (5 or 6, moist) and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam and very fine sandy loam. Reaction is mildly alkaline or moderately alkaline.

Kuma series

The Kuma series consists of deep, well drained, moderately permeable soils on silty, loess-covered uplands. Slope ranges from 0 to 6 percent.

Kuma soils are similar to Goshen soils and are commonly adjacent to Alliance, Keith, and Scott soils, all of which do not have a buried soil. Alliance soils have a mollic epipedon less than 20 inches thick and have bedrock at a depth of 40 to 60 inches. Keith soils have a mollic epipedon less than 20 inches thick. Alliance and Keith soils are on similar landscapes. Scott soils are poorly drained, have more clay in the subsoil than Kuma soils, and are in shallow depressions.

Typical pedon of Kuma silt loam, 0 to 1 percent slopes (fig. 19), 1,200 feet west and 175 feet north of the southeast corner of sec. 25, T. 5 N., R. 37 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

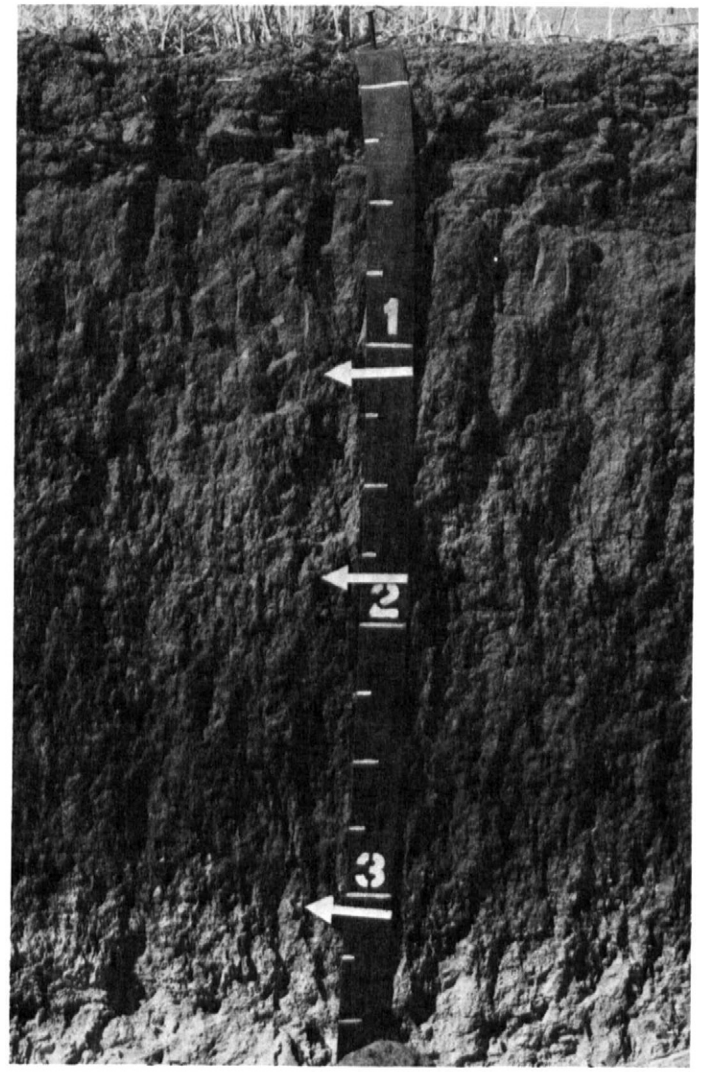

Figure 19.—Profile of Kuma silt loam, 0 to 1 percent slopes. The upper marker indicates the lower boundary of the A horizon. The middle marker indicates the top of an old buried surface layer, and the lower marker indicates the bottom of that layer. Depth is marked in feet.

B1—5 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, very friable; few very fine roots; neutral; clear smooth boundary.

B21t—10 to 18 inches; grayish brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; few very fine roots; common very fine pores; thin discontinuous clay films on faces of peds; neutral; abrupt smooth boundary.

B22tb—18 to 29 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; few very fine roots; common very fine pores; thin continuous clay films on faces of peds; neutral; abrupt smooth boundary.

B23tcab—29 to 35 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable; few very fine roots; few very fine tubular pores; common lime coatings on faces of peds; few worm casts and channels 3 to 6 millimeters in diameter; few thin discontinuous clay films on faces of peds; violent effervescence; moderately alkaline; clear smooth boundary.

B3cab—35 to 42 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable; lime coatings on many faces of peds; many myceliumlike filaments and threads of lime; many worm casts and channels 5 to 8 millimeters in diameter; violent effervescence; moderately alkaline; gradual smooth boundary.

Clca—42 to 48 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; common myceliumlike filaments and threads of lime; few worm casts and channels; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—48 to 60 inches; very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The solum is 30 to 60 inches thick. The depth to free carbonates ranges from 12 to 40 inches. The mollic epipedon is 30 to 40 inches thick.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 through 3. It is dominantly silt loam, but the range includes loam. Reaction is neutral or mildly alkaline. The upper part of the B2t horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 through 3. It is dominantly silty clay loam, but the range includes silt loam. Reaction is neutral or mildly alkaline. The B2tb horizon has value of 4 or 5 (2 or 3, moist) and chroma of 1 through 3. It is dominantly silty clay loam, but the range includes silt loam. Reaction ranges from neutral to moderately alkaline. The B2tcab horizon has color value of 4 through 7 (2 through 4, moist) and chroma of 1 through 4. It is dominantly silty clay loam, but the range includes silt loam. Reaction ranges from neutral to moderately alkaline. The C horizon has hue of 5Y through 7.5YR, value of 5 through 8 (4 through 7, moist), and chroma of 2 through 4. Texture is dominantly silt loam, but the range includes loam.

Laird series

The Laird series consists of deep, moderately well drained, moderately rapidly permeable soils on uplands. The soils are saline-alkali and formed in loamy eolian deposits. Slope ranges from 0 to 3 percent.

Laird soils commonly are adjacent to Haxtun, Jayem, and Valent soils, all of which do not contain soluble salts. Haxtun soils are noncalcareous, are more clayey throughout, and have a buried horizon. Haxtun soils are at a slightly higher elevation than Laird soils. Jayem soils are noncalcareous and are at a higher elevation. Valent soils are sandier throughout; they do not have a mollic epipedon, and they are at a higher elevation.

Typical pedon of Laird fine sandy loam, 0 to 3 percent slopes, 900 feet south and 300 feet east of the northwest corner of sec. 14, T. 5 N., R. 42 W.

A1—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; common very fine and fine roots; 18 percent calcium carbonate equivalent; slightly saline; violent effervescence; strongly alkaline; clear smooth boundary.

AC—10 to 16 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; slightly hard, very friable; few very fine roots; 28 percent calcium carbonate equivalent; moderately saline; violent effervescence; strongly alkaline; abrupt wavy boundary.

C1ca—16 to 26 inches; light gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) moist; common medium distinct light yellowish brown (2.5Y 6/4) mottles, olive brown (2.5Y 4/4) moist; weak medium subangular blocky structure; slightly hard, very friable; few fine pores; many soft masses of calcium carbonate; few fossilized shells; 40 percent calcium carbonate equivalent; strongly saline; violent effervescence; strongly alkaline; diffuse wavy boundary.

C2—26 to 60 inches; light gray (2.5Y 7/2) fine sandy loam, light brownish gray (2.5Y 6/2) moist; common medium prominent yellow (5Y 7/6) mottles, olive yellow (5Y 6/6) moist; massive; slightly hard, very friable; few very fine pores; few soft masses of calcium carbonate; 8 percent calcium carbonate equivalent; strongly saline; violent effervescence; strongly alkaline.

The solum is 12 to 32 inches thick. The mollic epipedon is 8 to 20 inches thick.

The A horizon has hue of 10YR or 2.5Y, value of 4 or 5 (2 or 3, moist), and chroma of 2 of 3. It is dominantly fine sandy loam, but the range includes loamy fine sand. Reaction is moderately alkaline or strongly alkaline. The

Cca horizon has hue of 2.5Y. It is dominantly very fine sandy loam, but the range includes fine sandy loam. The calcium carbonate equivalent ranges from 15 to 40 percent. Reaction ranges from moderately alkaline to very strongly alkaline. The C2 horizon has hue of 2.5Y or 5Y. It is dominantly fine sandy loam, but the range includes loamy fine sand and loamy sand. Reaction ranges from mildly alkaline to strongly alkaline.

Mace series

The Mace series consists of moderately deep, well drained, moderately slowly permeable soils on uplands. The soils formed in loess over silty residuum of weakly cemented caliche. Slope ranges from 0 to 3 percent.

Mace soils are similar to Rosebud soils and commonly are adjacent to Alliance, Canyon, Goshen, Kuma, and Scott soils. Rosebud soils have more sand in the subsoil than Mace soils. Alliance soils are deeper and are slightly higher on the landscape. Canyon soils are shallow and do not have a mollic epipedon. They are in slightly higher positions. Goshen and Kuma soils are deep and have a mollic epipedon more than 20 inches thick, and Kuma soils have a buried dark surface soil. They are slightly higher on the landscape. Scott soils are deep, have more clay in the subsoil, and are in depressions.

Typical pedon of Mace silt loam, 0 to 1 percent slopes, 1,782 feet east and 330 feet north of the southwest corner of sec. 36, T. 8 N., R. 41 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

B21t—5 to 11 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; few very fine pores; neutral; clear smooth boundary.

B22tb—11 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark brown (10YR 2/2) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; hard, friable; few very fine pores; few clay films on faces of peds; neutral; clear smooth boundary.

B3cab—18 to 23 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; numerous worm casts and channels 3 to 10 millimeters in diameter; common films and threads of calcium carbonate; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cca—23 to 30 inches; light gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable; many soft white masses of calcium carbonate; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—30 to 60 inches; white (10YR 8/2) weakly cemented caliche; violent effervescence.

The solum is 18 to 32 inches thick. The mollic epipedon is 10 to 20 inches thick. The depth to free carbonates ranges from 12 to 30 inches. The depth to bedrock ranges from 20 to 40 inches.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2. It is dominantly silt loam, but the range includes loam or very fine sandy loam. The B2t horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2. It commonly is silty clay loam, clay loam, or silt loam. On the average, it is between 25 and 35 percent clay. Reaction is neutral or mildly alkaline. The Cca horizon has value of 6 or 7 (4 or 5, moist) and chroma of 2 or 3. It is dominantly silt loam, but the range includes very fine sandy loam or fine sandy loam. Reaction is mildly alkaline or moderately alkaline.

McCash series

The McCash series consists of deep, well drained, moderately permeable soils in swales on uplands. The soils formed in loamy colluvial material. Slope ranges from 0 to 1 percent.

McCash soils are similar to Vetal soils and commonly are adjacent on the landscape to Ascalon, Jayem, Sarben, and Woodly soils. Vetal soils have less silt throughout than McCash soils. Ascalon soils have more clay in the subsoil and have a mollic epipedon less than 20 inches thick. Jayem soils have less silt throughout and have a mollic epipedon less than 20 inches thick. Sarben soils have less silt throughout and do not have a mollic epipedon. Woodly soils have more clay in the subsoil. Ascalon, Jayem, and Sarben soils are in higher positions on the landscape. Vetal and Woodly soils are in positions on the landscape similar to those of McCash soils.

Typical pedon of McCash very fine sandy loam, 0 to 1 percent slopes, 200 feet west and 100 feet south of the northeast corner of sec. 7, T. 7 N., R. 36 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; common very fine roots; slightly acid; abrupt smooth boundary.

A12—5 to 16 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable; common very fine roots; neutral; clear smooth boundary.

B21—16 to 28 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few very fine roots; few worm casts and channels; neutral; clear smooth boundary.

B22—28 to 46 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, friable; common very fine pores; neutral; gradual wavy boundary.

C—46 to 60 inches; pale brown (10YR 6/3) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; mildly alkaline.

The solum is 24 to 48 inches thick. The mollic epipedon is 20 to 48 inches thick.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. It is typically very fine sandy loam; less commonly, it is loamy very fine sand or silt loam. Reaction ranges from slightly acid to mildly alkaline. The B2 horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. It is typically very fine sandy loam; less commonly, it is loamy very fine sand or silt loam. Reaction ranges from slightly acid to mildly alkaline. The C horizon has value of 5 through 7 (4 or 5, moist) and chroma of 2 or 3. It is typically very fine sandy loam; less commonly, it is loamy very fine sand or fine sandy loam. Reaction is neutral or mildly alkaline.

McCook series

The McCook series consists of deep, well drained and moderately well drained, moderately permeable soils on bottom lands and low stream terraces. The soils formed in weakly stratified, calcareous, silty alluvium. Slope ranges from 0 to 2 percent.

McCook soils commonly are adjacent to Bridget, Gibbon, and Wann soils. Bridget soils do not have stratification and are in slightly higher positions. Gibbon soils are somewhat poorly drained and are below McCook soils on the landscape. Wann soils are somewhat poorly drained, have more sand throughout, and are below McCook soils.

Typical pedon of McCook silt loam, 0 to 2 percent slopes, 900 feet south and 700 feet east of the northwest corner of sec. 4, T. 6 N., R. 36 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; few very fine roots; mildly alkaline; abrupt smooth boundary.

A12—5 to 10 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak coarse granular; soft, very friable; few very fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

AC—10 to 18 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium granular; soft, very friable; few very fine roots; strong effervescence; moderately alkaline; clear smooth boundary.

C1—18 to 25 inches; pale brown (10YR 6/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; few very fine roots; few very fine pores; finely stratified; violent effervescence; moderately alkaline; abrupt smooth boundary.

C2—25 to 43 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; few very fine roots; violent effervescence; moderately alkaline; clear smooth boundary.

C3—43 to 60 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; few very fine roots; violent effervescence; moderately alkaline.

The solum is 16 to 30 inches thick. The mollic epipedon is 10 to 20 inches thick. The depth to free carbonates ranges from 0 to 10 inches.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2. It is dominantly silt loam, but the range includes very fine sandy loam and loam. The AC and C horizons have color value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3. They are dominantly silt loam or very fine sandy loam. Reaction is mildly or moderately alkaline.

McCook silt loam, channeled, 0 to 3 percent slopes, (map unit MtB), has a surface layer that is stratified and is not so dark or deep as is prescribed in the range for the McCook series, but this difference does not affect the use or behavior of the soil.

Otero series

The Otero series consists of deep, well drained, moderately rapidly permeable soils on uplands. The soils formed in loamy calcareous material. Slope ranges from 6 to 45 percent.

Otero soils commonly are adjacent on the landscape to Canyon soils. Canyon soils have bedrock at a depth of 6 to 20 inches and are higher on the landscape.

Typical pedon of Otero loam, in an area of Otero-Canyon loams, 20 to 45 percent slopes, 1,550 feet east and 1,700 feet north of the southwest corner of sec. 10, T. 5 N., R. 37 W.

A1—0 to 7 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate very fine and fine granular structure; soft, very friable; many very fine roots; about 4 percent caliche chips and fragments; violent effervescence; moderately alkaline; clear smooth boundary.

AC—7 to 16 inches; light brownish gray (10YR 6/2) very fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; common very fine roots; about 6 percent caliche chips and fragments; violent effervescence; moderately alkaline; gradual smooth boundary.

C—16 to 60 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; few very fine roots in the upper 10 inches; about 13 percent caliche chips and fragments; violent effervescence; moderately alkaline.

The solum is 10 to 22 inches thick. The depth to free carbonates ranges from 0 to 4 inches. Coarse fragments larger than 2 millimeters make up 2 to 15 percent.

The A horizon has color value of 5 or 6 (4 or 5, moist) and chroma of 1 through 3. It is dominantly loam, but the range includes very fine sandy loam, fine sandy loam, and sandy loam. Reaction is mildly alkaline or moderately alkaline. The C horizon has color value of 6 through 8 (5 through 7, moist) and chroma of 2 through 4. Reaction is moderately alkaline or strongly alkaline.

Rosebud series

The Rosebud series consists of moderately deep, well drained, moderately permeable soils on uplands. The soils formed in calcareous, loamy material that weathered from weakly cemented caliche. Slope ranges from 0 to 11 percent.

Rosebud soils are similar to Mace soils and are commonly adjacent on the landscape to Alliance, Ascalon, and Canyon soils. Mace and Alliance soils have more silt in the subsoil and are at a lower elevation than Rosebud soils. Alliance and Ascalon soils are deep. Canyon soils are shallow and do not have a mollic epipedon.

Typical pedon of Rosebud loam, 0 to 1 percent slopes, 175 feet south and 125 feet east of the northwest corner of sec. 19, T. 7 N., R. 41 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

B2t—5 to 15 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, firm; few very fine tubular pores; thin clay films on faces of peds; neutral; clear smooth boundary.

B3ca—15 to 20 inches; light brownish gray (10YR 6/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable; few very fine tubular pores; few soft white masses of calcium carbonate; violent effervescence; moderately alkaline; clear smooth boundary.

Cca—20 to 34 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, very friable; few hard fragments of caliche; few soft white masses of calcium carbonate; violent effervescence; moderately alkaline; abrupt wavy boundary.

Cr—34 to 60 inches; white (10YR 8/2) weakly cemented caliche; violent effervescence.

The solum is 14 to 26 inches thick. The depth to free carbonates ranges from 14 to 30 inches. The mollic epipedon is 9 to 20 inches thick. The depth to bedrock ranges from 20 to 40 inches.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. Reaction is neutral or mildly alkaline. The B2t horizon has color value of 4 through 6 (3 or 4, moist) and chroma of 2 or 3. It is mainly clay loam, but the range includes loam. The clay content on the average is 18 to 35 percent. Reaction is neutral or mildly alkaline. The C horizon has color value of 6 or 7 (5 or 6, moist) and chroma of 3 or 4. It is mainly loam, but the range includes clay loam, sandy clay loam, fine sandy loam, sandy loam, and very fine sandy loam. The Cr horizon generally is less than 3 on the Mohs scale, but in some pedons there is an R horizon of hard, impervious bedrock.

Sarben series

The Sarben series consists of deep, well drained, moderately rapidly permeable soils on uplands. The soils formed in reworked loamy Tertiary material. Slope ranges from 3 to 9 percent.

Sarben soils are similar to Jayem soils and commonly are adjacent to Ascalon, Satanta, Valent, and Woodly soils. Unlike Sarben soils, Jayem soils have a mollic epipedon. Ascalon and Satanta soils also have a mollic epipedon, and they have more clay in the subsoil than Sarben soils. Ascalon soils are on similar landscapes. Satanta soils are at a lower elevation. Valent soils are sandy throughout and are above Sarben soils on the landscape. Woodly soils have a mollic epipedon more than 20 inches thick and have more clay throughout. They are below Sarben soils on the landscape.

Typical pedon of Sarben loamy very fine sand, 3 to 6 percent slopes, 2,250 feet south and 750 feet west of the northeast corner of sec. 24, T. 8 N., R. 36 W.

A1—0 to 6 inches; brown (10YR 5/3) loamy very fine sand, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, very friable; few very fine roots; slightly acid; abrupt smooth boundary.
AC—6 to 17 inches; pale brown (10YR 6/3) loamy very fine sand, brown (10YR 4/3) moist; weak medium subangular blocky structure; slightly hard, very friable; few very fine roots; neutral; clear smooth boundary.
C1—17 to 27 inches; very pale brown (10YR 7/3) loamy very fine sand, brown (10YR 5/3) moist; massive; soft, very friable; neutral; clear smooth boundary.
C2—27 to 60 inches; very pale brown (10YR 7/3) loamy very fine sand, brown (10YR 5/3) moist; massive; soft, very friable; slight effervescence; moderately alkaline.

The solum is 4 to 24 inches thick. The depth to carbonates ranges from 24 to more than 60 inches.

The A horizon has color value of 4 through 6 (3 through 5, moist) and chroma of 2 or 3. It is loamy very fine sand, loamy fine sand, or fine sandy loam. Reaction is slightly acid or neutral. The AC horizon has color value of 5 or 6 (4 or 5, moist) and chroma of 2 or 3. It is loamy very fine sand, fine sandy loam, or very fine sandy loam. Reaction is slightly acid or neutral. The C horizon has color value of 5 through 8 (4 through 6, moist) and chroma of 2 or 3. It is loamy very fine sand, fine sandy loam, or very fine sandy loam. Reaction is neutral through moderately alkaline.

Satanta series

The Satanta series consists of deep, well drained, moderately permeable soils on uplands. The soils formed in loamy eolian material. Slope ranges from 1 to 6 percent.

Satanta soils are similar to Ascalon and Woodly soils and commonly are adjacent to Jayem and Woodly soils. Ascalon soils have a subsoil that averages more than 35 percent fine and coarser sand. Woodly soils have a mollic epipedon more than 20 inches thick. Jayem soils have more sand throughout and are in higher positions than Satanta soils.

Typical pedon of Satanta very fine sandy loam, 1 to 3 percent slopes, 800 feet east and 150 feet south of the northwest corner of sec. 1, T. 8 N., R. 37 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) very fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable; common very fine roots; neutral; abrupt smooth boundary.
A12—5 to 9 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; hard, very friable; few very fine roots; neutral; clear smooth boundary.
B21t—9 to 17 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure parting to strong medium subangular blocky; very hard, firm; few very fine roots; few thin clay films on faces of peds; few small worm casts and channels; neutral; clear smooth boundary.
B22t—17 to 23 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; strong medium prismatic structure parting to strong medium subangular blocky structure; very hard, firm; neutral; gradual smooth boundary.
B3—23 to 30 inches; light yellowish brown (2.5Y 6/4) loam, olive brown (2.5Y 4/4) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, firm; mildly alkaline; clear smooth boundary.
Cca—30 to 60 inches; light gray (2.5Y 7/2) loam, light yellowish brown (2.5Y 6/4) moist; massive; slightly hard, very friable; common fine pores; many myceliumlike filaments of calcium carbonate; violent effervescence; moderately alkaline.

The solum is 20 to 40 inches thick. The depth to free carbonates ranges from 15 to 36 inches. The mollic epipedon is 8 to 20 inches thick.

The A horizon has value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. It is dominantly very fine sandy loam, but the range includes loam and fine sandy loam. Reaction ranges from slightly acid to mildly alkaline. The B2t horizon has hue of 10YR or 2.5Y, value of 4 through 6 (3 through 5, moist), and chroma of 2 through 4. It is clay loam, sandy clay loam, or loam. Reaction ranges from neutral to moderately alkaline. The C horizon has hue of 10YR or 2.5Y, value of 5 through 7 (4 through 6, moist), and chroma of 2 through 4. It is loam, sandy clay loam, or fine sandy loam. Reaction is mildly alkaline or moderately alkaline.

Scott series

The Scott series consists of deep, poorly drained, very slowly permeable soils in depressions on loess-covered uplands. Slope ranges from 0 to 1 percent.

Scott soils commonly are adjacent on the landscape to Alliance, Goshen, Kuma, and Mace soils. All of these soils are better drained than Scott soils, have less clay in the subsoil, and are above Scott soils on the landscape.

Typical pedon of Scott silt loam, 0 to 1 percent slopes, 2,100 feet north and 1,400 feet west of the southeast corner of sec. 22, T. 5 N., R. 38 W.

A1—0 to 2 inches; grayish brown (10YR 5/2) silt loam, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure parting to moderate medium granular; slightly hard, very friable; few very fine roots; few worm casts; slightly acid; abrupt smooth boundary.

A2—2 to 4 inches; gray (10YR 6/1) silt loam, dark gray (10YR 4/1) moist; moderate thin and medium platy structure parting to moderate fine subangular blocky; slightly hard, very friable; few very fine roots; slightly acid; abrupt smooth boundary.

B21t—4 to 14 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong medium prismatic structure parting to strong very fine and fine angular blocky; very hard, very firm; few very fine roots; continuous clay films on faces of most peds; neutral; clear smooth boundary.

B22t—14 to 23 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; strong coarse prismatic structure parting to strong fine angular blocky; very hard, very firm; few very fine roots; continuous clay films on faces of most peds; few small round black ferromanganese concretions; neutral; clear smooth boundary.

B3—23 to 32 inches; light brownish gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, very firm; numerous worm channels and casts; neutral; gradual smooth boundary.

C1—32 to 48 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; slightly hard, very friable; common very fine continuous vertical tubular pores; neutral; gradual smooth boundary.

C2—48 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; mildly alkaline.

The thickness of the solum ranges from 27 to 56 inches. The depth to carbonates ranges from 36 to 60 inches or more.

The A1 horizon has value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2. The A2 horizon has value of 5 or 6 (4 or 5, moist) and chroma of 1. The B2t horizon has hue of 10YR or 2.5Y, value of 3 through 5 (2 or 3, moist), and chroma of 1 or 2. It is silty clay or clay and averages between 40 and 55 percent clay. Reaction is neutral or mildly alkaline. The C horizon has hue of 10YR or 2.5Y, value of 5 through 7 (4 through 6, moist), and chroma of 2 through 4.

Tassel series

The Tassel series consists of shallow, well drained, moderately rapidly permeable soils on uplands. The soils formed in calcareous, sandy and loamy material over weakly cemented caliche. Slope ranges from 0 to 30 percent.

Tassel soils are similar to Canyon soils and are commonly adjacent to Duda and Valent soils. Canyon soils have more than 12 percent clay in the control section. Duda soils have more sand throughout than Tassel soils and have bedrock at a depth of 20 to 40 inches. Duda soils are in higher positions than Tassel soils. Valent soils are deep and have more sand throughout. Valent soils are above Tassel soils on the landscape.

Typical pedon of Tassel loamy sand, in an area of Tassel-Duda loamy sands, 0 to 3 percent slopes, 2,150 feet south and 800 feet east of the northwest corner of sec. 14, T. 8 N., R. 40 W.

A11—0 to 6 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; single grained; loose; common very fine roots; slight effervescence; mildly alkaline; gradual smooth boundary.

A12—6 to 9 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak very fine subangular blocky structure; slightly hard, very friable; common very fine roots; few small caliche chips; violent effervescence; moderately alkaline; clear smooth boundary.

C—9 to 16 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable; few very fine roots; many small caliche chips; violent effervescence; moderately alkaline; clear wavy boundary.

IICr—16 to 60 inches; white (10YR 8/1) weakly cemented caliche; violent effervescence; strongly alkaline.

The thickness of the solum ranges from 3 to 9 inches. The depth to bedrock ranges from 6 to 20 inches. The depth to free carbonates ranges from 0 to 3 inches. Reaction is mildly alkaline or moderately alkaline throughout.

The A horizon has value of 4 through 7 (3 through 6, moist) and chroma of 2 or 3. It is loamy sand, loamy fine sand, or fine sandy loam. The C horizon has value of 5 through 7 (4 through 6, moist) and chroma of 2 or 3. It is fine sandy loam or loamy very fine sand.

Ulysses series

The Ulysses series consists of deep, well drained, moderately permeable soils on uplands. The soils formed in calcareous, silty loess. Slope ranges from 3 to 9 percent.

Ulysses soils commonly are adjacent to Colby, Keith, and Kuma soils. Colby soils do not have a mollic epipedon. Colby soils are below Ulysses soils on the landscape. Keith and Kuma soils have more clay

throughout. They are below Ulysses soils on the landscape.

Typical pedon of Ulysses silt loam, 3 to 6 percent slopes, eroded, 600 feet east and 200 feet north of the southwest corner of sec. 36, T. 5 N., R. 37 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; few very fine roots; neutral; abrupt smooth boundary.

B2—5 to 12 inches; brown (10YR 5/3) silt loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, very friable; few very fine roots; mildly alkaline; clear smooth boundary.

C1—12 to 36 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium prismatic structure; soft, very friable; many myceliumlike filaments and threads of carbonate; few white soft masses of carbonate; violent effervescence; moderately alkaline; gradual smooth boundary.

C2—36 to 60 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; massive; soft, very friable; violent effervescence; moderately alkaline.

The solum is 10 to 18 inches thick. The depth to free carbonates ranges from 7 to 15 inches. The mollic epipedon is 7 to 18 inches thick.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 2 or 3. It is dominantly silt loam, but the range includes loam. It is neutral or mildly alkaline. The B2 horizon has color value of 4 through 6 (3 or 4, moist) and chroma of 2 or 3. It is silt loam or silty clay loam. It is mildly alkaline or moderately alkaline. The C horizon has color value of 5 through 7 (4 through 6, moist) and chroma of 2 through 4. It is generally silt loam, but the range includes loam.

Valent series

The Valent series consists of deep, excessively drained, very rapidly permeable soils on uplands. The soils formed in eolian sand. Slope ranges from 0 to 60 percent.

Valent soils are similar to Dailey soils and commonly are adjacent on the landscape to Duda, Haxtun, Jayem, Tassel, and Vetal soils. All these soils are at a lower elevation than Valent soils. Unlike Valent soils, Dailey soils have a mollic epipedon, and Duda soils have bedrock at a depth of 20 to 40 inches. Haxtun and Vetal soils have a mollic epipedon more than 20 inches thick and have more clay throughout than Valent soils. Jayem soils have a mollic epipedon, and they also have more clay throughout. Tassel soils have bedrock at a depth of 6 to 20 inches.

Typical pedon of Valent sand, rolling, 700 feet north and 200 feet west of the southeast corner of sec. 16, T. 8 N., R. 38 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose; neutral; gradual smooth boundary.

C—4 to 60 inches; light yellowish brown (10YR 6/4) sand, yellowish brown (10YR 5/4) moist; single grain; loose; neutral.

The solum is 3 to 10 inches thick. Free carbonates are at a depth of 40 to more than 60 inches.

The A horizon has color value of 5 or 6 (3 through 5, moist) and chroma of 2 or 3. It is dominantly sand, but the range includes fine sand and loamy sand. The C horizon is dominantly sand, but the range includes fine sand.

Vetal series

The Vetal series consists of deep, well drained, moderately rapidly permeable soils in swales on uplands. The soils formed in loamy eolian material. Slope ranges from 0 to 3 percent.

Vetal soils are similar to Jayem soils and commonly are adjacent to Haxtun and Valent soils. Jayem soils have a mollic epipedon less than 20 inches thick. Haxtun soils have more clay in the subsoil than Vetal soils. Valent soils do not have a mollic epipedon and are sandier throughout. Valent soils are higher on the landscape than Vetal soils.

Typical pedon of Vetal fine sandy loam, 0 to 3 percent slopes, 1,000 feet west and 150 feet north of the southeast corner of sec. 7, T. 8 N., R. 39 W.

A11—0 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; soft, very friable; common very fine roots; neutral; clear smooth boundary.

A12—9 to 22 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; few very fine roots; few very fine tubular pores; neutral; clear smooth boundary.

AC—22 to 48 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; slightly hard, very friable; few very fine tubular pores; neutral; gradual smooth boundary.

C—48 to 60 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; few very fine tubular pores; neutral.

The solum is 24 to 60 inches thick. The mollic epipedon is 32 to 48 inches thick.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2. It is dominantly fine sandy loam,

but the range includes sandy loam and loamy very fine sand. The AC horizon has color value of 4 through 6 (3 or 4, moist) and chroma of 1 through 3. It generally is fine sandy loam, but the range includes sandy loam and very fine sandy loam.

Wann series

The Wann series consists of deep, somewhat poorly drained, moderately rapidly permeable soils on bottom lands. The soils formed in stratified, calcareous, loamy alluvium. Slope ranges from 0 to 2 percent.

Wann soils are commonly adjacent to Bridget and McCook soils. Bridget and McCook soils are better drained, have more silt throughout, and are at a slightly higher elevation than Wann soils.

Typical pedon of Wann fine sandy loam, 0 to 2 percent slopes, 2,700 feet east and 800 feet north of the southwest corner of sec. 1, T. 5 N., R. 37 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable; common very fine and few fine roots; many worm channels and casts 2 to 5 millimeters in diameter; strong effervescence; moderately alkaline; abrupt smooth boundary.

A12—5 to 12 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium and coarse granular; soft, very friable; common very fine roots; many worm channels and casts 2 to 5 millimeters in diameter; strong effervescence; moderately alkaline; clear smooth boundary.

C1—12 to 26 inches; light gray (10YR 7/2) fine sandy loam, grayish brown (10YR 5/2) moist; few fine faint yellowish brown (10YR 5/4) mottles; massive; soft, very friable; common very fine roots; coarsely stratified with lenses of very fine sandy loam, loamy fine sand, and sand; violent effervescence; moderately alkaline; abrupt wavy boundary.

C2—26 to 48 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; common medium distinct strong brown (7.5YR 5/8) mottles; massive; soft, very friable; few very fine roots; stratified with layers of loamy fine sand, fine sand, and coarse sand; strong effervescence; moderately alkaline; abrupt wavy boundary.

C3—48 to 60 inches; light gray (10YR 7/2) very fine sandy loam, grayish brown (10YR 5/2) moist; few fine faint brownish yellow (10YR 6/6) mottles; massive; soft, very friable; coarsely stratified with layers of fine and coarse sand; strong effervescence; moderately alkaline.

The solum and the mollic epipedon are 11 to 20 inches thick. The depth to free carbonates ranges from 0 to 11 inches.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes loam and sandy loam. Reaction ranges from neutral through moderately alkaline. In some places, there is an AC horizon. The C horizon has color value of 5 through 7 (4 through 6, moist). It is dominantly stratified fine sandy loam and very fine sandy loam, but the range includes sandy loam. Reaction is mildly alkaline or moderately alkaline.

Woodly series

The Woodly series consists of deep, well drained, moderately permeable soils on uplands. The soils formed in loamy material. Slope ranges from 0 to 3 percent.

Woodly soils are similar to Haxtun soils and commonly are adjacent to Ascalon and Jayem soils. Haxtun soils have a horizon that is a buried soil. Ascalon soils have a mollic epipedon less than 20 inches thick. Jayem soils have a mollic epipedon less than 20 inches thick and have less clay in the subsoil.

Typical pedon of Woodly fine sandy loam, 0 to 3 percent slopes. 1,450 feet west and 100 feet north of the southeast corner of sec. 20, T. 6 N., R. 39 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; common very fine roots; neutral; abrupt smooth boundary.

A12—5 to 16 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure parting to weak medium granular; slightly hard, very friable; few very fine roots; neutral; clear smooth boundary.

B21t—16 to 28 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few very fine roots; few fine tubular pores; thin patchy clay films on faces of peds; few worm channels and casts; neutral; clear smooth boundary.

B22t—28 to 38 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; thin discontinuous clay films on faces of peds; neutral; clear smooth boundary.

B3—38 to 46 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; soft, very friable; neutral; gradual smooth boundary.

Cca—46 to 60 inches; light gray (10YR 7/2) sandy loam, grayish brown (10YR 5/2) moist; weak coarse prismatic structure; soft, very friable; violent effervescence; moderately alkaline.

The solum is 30 to 56 inches thick. The mollic epipedon is 20 to 45 inches thick. Free carbonates are at a depth of 25 to 55 inches.

The A horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 or 2. It is dominantly fine sandy loam, but the range includes sandy loam and loamy fine sand. Reaction is slightly acid or neutral. The B2t horizon has color value of 4 or 5 (2 or 3, moist) and chroma of 1 through 3. It is dominantly sandy clay loam, but the range includes loam and fine sandy loam. On the average, the B2t horizon is between 18 and 27 percent clay. It is neutral or mildly alkaline. The B3 horizon has color value of 5 through 7 (4 through 6, moist) and chroma of 2 through 4. It is dominantly fine sandy loam, but the range includes very fine sandy loam and sandy loam. The Cca horizon has color value of 6 or 7 (5 through 6, moist) and chroma of 2 through 4. It is dominantly sandy loam, but the range includes very fine sandy loam, fine sandy loam, sandy loam, and loamy fine sand.

formation of the soils

Soil is produced by soil-forming processes that act on materials deposited or accumulated by geologic agencies. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, or lay of the land, and the length of time the processes of soil formation have acted on the soil material.

Climate and plant and animal life, chiefly plants, are the active factors in soil formation. They act on the accumulated parent material and slowly change it to a natural body that has genetically related horizons. Relief conditions the effects of climate and plant and animal life. The parent material influences the kind of soil that is formed and in extreme cases determines it almost entirely. Finally, time is needed to change the parent material into soil. In general, a long time is required for distinct horizons to develop.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four.

parent material

Parent material, the unconsolidated mineral material in which a soil forms, determines the chemical and mineralogical composition of the soil. The soils in Chase County formed in material that weathered from the underlying geologic formations or in material that was transported by wind and water.

The Ogallala Formation extends throughout most of the county. In places it is at the surface, in other places it is several hundred feet below the surface. It is composed of beds of silt, sand, gravel, caliche, and clay (*4*). Part of the Ogallala Formation is cemented by calcium carbonate. The rock thus formed ranges from friable caliche that is only partly indurated to relatively hard, resistant, ledge-forming mortar beds. Ascalon, Canyon, Rosebud, and Woodly soils formed in weathered Ogallala material.

Loess, or wind-deposited silty material, mantles much of the uplands in the county. This loess is a friable, massive, yellowish brown material, which ranges from about 3.5 feet to several hundred feet in thickness. The deposits of loess are thicker on the eastern and southern divides. The loess is calcareous and contains a few lime concretions. Colby, Keith, Kuma, and Ulysses soils formed in loess. Alliance and Mace soils formed in loess over weathered Ogallala material. Scott soils, which are in upland depressions, formed in loess that has been modified by water.

Eolian sand makes up a large part of the parent material in Chase County. This is a wind-deposited material that consists mainly of quartz and feldspar minerals. The average thickness of the eolian sand is about 15 feet. In some places, however, it is 160 feet thick. Dailey and Valent soils formed in loamy and sandy eolian material. Duda and Tassel soils formed in eolian sand over the Ogallala Formation.

Colluvium is material that accumulated as a result of the combined forces of gravity and water. In Chase County, it is on foot slopes of hills on uplands. Bridget, Creighton, and McCash soils formed in colluvial material.

Alluvium is the parent material of the soils on flood plains and stream terraces. It is sandy to silty material that has been deposited by streams. From time to time, floodwater deposits new sediment on the bottom lands. Caruso, Gibbon, McCook, and Wann soils formed in alluvium on bottom lands. The oldest alluvium is on stream terraces, which are above the present flood plain and are not subject to flooding. Bridget, Creighton, McCash, and McCook soils formed in this material.

Sand and gravel beds of Pleistocene age in some areas, mainly in the west-central part of Chase County, have a thin mantle of silty and loamy water- or wind-deposited sediment. Altvan soils formed in this material.

climate

The climate of Chase County is semiarid. It is characterized by light rainfall, cold winters, warm summers, high winds, and frequent changes in weather conditions. Temperatures of about 90° F in summer and around 20° F in winter are common. The mean annual temperature is 51° F, and the average annual precipitation is 19 inches. The average growing season is about 136 days. The prevailing wind is from the northwest. Severe dust storms occur in spring when strong dry winds blow over unprotected soils. Tornadoes and severe thunderstorms, sometimes with hail, occur occasionally.

Because the climate is fairly uniform throughout the county, differences in the soils are the result of the

interrelationship of the climate and the other soil-forming factors. For example, the amount of leaching is dependent not only on the amount of precipitation but also on the local relief. The steeply sloping soils that are more exposed to the wind have greater runoff and evaporation and less leaching than the nearly level soils that receive the same amount of rainfall. Rain, melting snow, and wind cause erosion, which can prevent the development of a thick surface layer, especially on the steeper soils.

Climate influences the rate at which parent material is weathered and reworked by rain, temperature, and wind. Soil formation progresses slowly when the soil is dry, and soils in arid regions generally are less well developed than those in humid regions. The amount of moisture, the length of the growing season, and the prevailing temperature during the growing season affect the amount of vegetation, which is the main source of organic matter in the soil. These factors also directly affect the activity of the micro-organisms that convert organic matter to humus. Wind can remove the top layer of the soil or deposit a mantle of sediment on the soil.

plant and animal life

After the parent material was deposited, bacteria, fungi, and other simple forms of life invaded the soil. After a time, prairie grasses began to grow and fibrous roots penetrated to a depth of several feet. The grass roots helped to keep the soils productive by bringing water and soluble minerals, such as calcium, iron, phosphorus, nitrogen, and sulfur, from the deeper horizons. Roots also helped to develop better soil structure and improve soil aeration.

When plants decay, micro-organisms act on the organic matter and decompose it into stable humus. These micro-organisms include bacteria, nematodes, and protozoa. Nitrogen-fixing bacteria in nodules on the roots of legumes remove nitrogen from the air; when the bacteria die, the nitrogen becomes available in the soil. Fungi and such small animals as millipedes, spiders, and mites also act on organic matter and help decompose it into humus. Earthworms, insects, and small burrowing animals mix and work the organic and mineral matter, promote soil development, and make the soil more friable.

As decayed organic matter accumulates, the color gradually darkens and the physical and chemical characteristics of the surface layer change. The soil is enriched with plant nutrients from the decaying organic matter. Tilth is improved, permeability to air and water is established, and water movement into and through the soil is increased. In Chase County, Gibbon and Kuma soils have a moderate content of organic matter, and Colby and Valent soils have a low content of organic matter.

relief

Relief influences soil formation mainly through its effect on drainage, runoff, and plant growth. The degree of slope, the shape of the surface, and the permeability of the soil determine the rate of runoff, the internal drainage, and the moisture content of the soil. Internal drainage and availability of moisture are important factors in the development of soil horizons.

The nearly level and gently sloping soils on uplands are more strongly developed than the steeper soils, and they have more distinct soil horizons. More moisture is absorbed, and water percolates deeper into the profile. Because lime and plant nutrients are leached to a greater depth, a B horizon develops. The nearly level Alliance soils and the nearly level and gently sloping Kuma soils have distinct horizons.

On steep slopes, where runoff is rapid and little moisture penetrates the soil, erosion removes the surface soil almost as fast as it forms. Lime and other elements are not leached so deeply. In Chase County, the steep and very steep Colby soils show little development of a soil profile other than a thin, slightly darkened surface layer.

Nearly level soils on bottom lands may receive extra water through runoff from adjacent slopes. In these areas, the soils are somewhat poorly drained and very poorly drained because of slow runoff or a moderately high water table. Where the water table is moderately high, moisture is brought from the saturation zone into the root zone by capillary action. The amount of moisture in the soil affects the kind and amount of vegetation, which in turn influence soil development. In Chase County, Caruso, Gannett, Gibbon, and Wann soils and Fluvaquents, silty, are somewhat poorly drained and very poorly drained.

Because of differences in relief, some processes of horizon differentiation are slowed and others are accelerated. Relief is a local factor of soil formation. Generally, soils that have gentle slopes have a thick solum and distinct horizons; soils that have steep slopes have a thinner solum and less distinct horizons.

time

Time is required for the formation of a mature soil. Mature or old soils have a thick, dark surface layer and a distinct subsoil. In Chase County, Alliance and Kuma soils are mature soils; they have well defined horizons.

Most of the soils on bottom lands do not have well developed horizons because new deposits of alluvium are laid down before soil development can take place. The upland soils that have moderately steep slopes have been in place long enough for horizons to form, but because of the slope, erosion removes soil material before well defined horizons can form. Caruso and Wann soils are immature soils on bottom lands, and Colby and Valent soils are immature soils on uplands.

The degree of profile development depends on the intensity of the soil-forming factors, on the length of time they have been active, and on the nature of the parent material. The distinctness of horizons in the soil profile commonly is proportional to the length of time that geologic materials have been in place.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. 4 tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth, soil. The total thickness of weathered soil material over bedrock or mixed sand and gravel. In this soil survey, the classes of soil depth are *deep,* more than 40 inches; *moderately deep,* 20 to 40 inches; *shallow,* 10 to 20 inches; and *very shallow,* 0 to 10 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons.

Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles,

28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Organic matter, soil. The organic fraction of the soil. It includes plant and animal residue at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil population. It is commonly determined as those organic materials that accompany the soil material when it is put through a 2-millimeter sieve. In this soil survey, the ratings for organic-matter content are:

moderate	2.0 to 4.0 percent
Moderately low	1.0 to 2.0 percent
Low	0.5 to 1.0 percent
Very low	less than 0.5 percent

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting ground ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas,

many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the

soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any "surface soil" horizon (A1, A2, or A3) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A horizon, including all subdivisions (A1, A2, and A3).

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-73 at Imperial, Nebraska]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days*	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	40.5	14.1	27.3	70	-14	0	.37	.05	.61	1	4.9
February---	45.2	18.5	31.9	77	-9	9	.46	.05	.76	2	4.9
March------	51.1	23.6	37.4	83	-4	33	.82	.28	1.25	3	7.5
April------	63.8	34.6	49.2	89	14	89	1.63	.55	2.49	3	2.5
May--------	73.7	46.1	59.9	94	29	315	3.38	1.42	4.96	6	.1
June-------	84.0	56.0	70.0	103	40	600	3.50	1.30	5.26	6	.0
July-------	89.7	61.6	75.7	104	49	797	2.97	1.63	4.07	6	.0
August-----	88.7	60.1	74.4	102	47	756	2.15	.96	3.10	4	.0
September--	78.9	49.5	64.2	99	31	426	1.80	.45	2.87	3	.0
October----	68.1	37.3	52.7	90	19	152	1.09	.38	1.64	3	2.1
November---	51.8	24.9	38.4	77	2	0	.56	.13	.89	1	4.1
December---	42.4	17.0	29.7	70	-12	0	.40	.15	.60	1	4.8
Yearly:											
Average--	64.8	36.9	50.9	---	---	---	---	---	---	---	---
Extreme--	---	---	---	104	-18	---	---	---	---	---	---
Total----	---	---	---	---	---	3,177	19.13	15.05	22.96	39	30.9

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-73 at Imperial, Nebraska]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 25	May 7	May 14
2 years in 10 later than--	April 20	May 2	May 10
5 years in 10 later than--	April 11	April 24	May 3
First freezing temperature in fall:			
1 year in 10 earlier than--	October 14	October 6	September 21
2 years in 10 earlier than--	October 19	October 10	September 26
5 years in 10 earlier than--	October 28	October 18	October 4

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-73 at Imperial, Nebraska]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	177	158	136
8 years in 10	184	164	142
5 years in 10	198	176	153
2 years in 10	212	187	164
1 year in 10	220	193	170

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ac	Alliance silt loam, 0 to 1 percent slopes	16,150	2.8
Af	Altvan loam, 0 to 1 percent slopes	2,230	0.4
AfB	Altvan loam, 1 to 3 percent slopes	2,500	0.4
AfC	Altvan loam, 3 to 6 percent slopes	580	0.1
AsB	Ascalon fine sandy loam, 1 to 3 percent slopes	12,140	2.1
AsC	Ascalon fine sandy loam, 3 to 6 percent slopes	4,600	0.8
BeB	Blanche very fine sandy loam, 0 to 3 percent slopes	2,240	0.4
Bg	Bridget silt loam, 0 to 1 percent slopes	620	0.1
BgB	Bridget silt loam, 1 to 3 percent slopes	1,820	0.3
BuC	Bushman very fine sandy loam, 1 to 4 percent slopes	1,440	0.3
Cb	Caruso loam, 0 to 2 percent slopes	1,230	0.2
ChD	Colby silt loam, 6 to 9 percent slopes	2,350	0.4
ChF	Colby silt loam, 9 to 30 percent slopes	17,580	3.1
ChG	Colby silt loam, 30 to 60 percent slopes	29,640	5.2
CrB	Creighton very fine sandy loam, 1 to 3 percent slopes	2,200	0.4
CrC	Creighton very fine sandy loam, 3 to 6 percent slopes	2,980	0.5
CrD	Creighton very fine sandy loam, 6 to 11 percent slopes	1,720	0.3
DbB	Dailey loamy sand, 0 to 3 percent slopes	5,380	0.9
DuC	Duda-Tassel loamy sands, 3 to 6 percent slopes	3,090	0.5
Fu	Fluvaquents, silty	350	0.1
Gb	Gannett silt loam, overwash, 0 to 2 percent slopes	2,830	0.5
Gf	Gibbon silt loam, 0 to 2 percent slopes	1,800	0.3
Gh	Goshen silt loam, 0 to 1 percent slopes	12,190	2.1
HaB	Haxtun loamy fine sand, 0 to 3 percent slopes	7,390	1.3
HdB	Haxtun fine sandy loam, 0 to 3 percent slopes	7,700	1.3
JaB	Jayem loamy fine sand, 0 to 3 percent slopes	9,510	1.7
JaC	Jayem loamy fine sand, 3 to 6 percent slopes	2,410	0.4
JcB	Jayem fine sandy loam, 0 to 3 percent slopes	5,680	1.0
JcC	Jayem fine sandy loam, 3 to 6 percent slopes	1,170	0.2
KeB	Keith silt loam, 1 to 3 percent slopes	1,400	0.2
KeC2	Keith silt loam, 3 to 6 percent slopes, eroded	570	0.1
Ku	Kuma silt loam, 0 to 1 percent slopes	34,750	6.1
KuB	Kuma silt loam, 1 to 3 percent slopes	11,400	2.0
KuC	Kuma silt loam, 3 to 6 percent slopes	850	0.1
LaB	Laird fine sandy loam, 0 to 3 percent slopes	1,800	0.3
Ma	Mace silt loam, 0 to 1 percent slopes	7,510	1.3
MaB	Mace silt loam, 1 to 3 percent slopes	920	0.2
Mc	Mace-Alliance silt loams, 0 to 1 percent slopes	7,180	1.3
McB	Mace-Alliance silt loams, 1 to 3 percent slopes	5,700	1.0
Mm	McCash very fine sandy loam, 0 to 1 percent slopes	1,420	0.2
Mo	McCook silt loam, 0 to 2 percent slopes	1,200	0.2
Mp	McCook silt loam, occasionally flooded, 0 to 2 percent slopes	820	0.1
MtB	McCook silt loam, channeled, 0 to 3 percent slopes	270	*
OaF	Otero-Canyon loams, 6 to 20 percent slopes	12,480	2.2
OaG	Otero-Canyon loams, 20 to 45 percent slopes	6,690	1.2
Rs	Rosebud loam, 0 to 1 percent slopes	17,040	3.0
RsB	Rosebud loam, 1 to 3 percent slopes	7,310	1.3
Rt	Rosebud-Canyon loams, leveled, 0 to 1 percent slopes	7,050	1.2
RtB	Rosebud-Canyon loams, 0 to 3 percent slopes	27,370	4.8
RtC	Rosebud-Canyon loams, 3 to 6 percent slopes	8,910	1.6
RtD2	Rosebud-Canyon loams, 6 to 11 percent slopes, eroded	1,850	0.3
SaC	Sarben loamy very fine sand, 3 to 6 percent slopes	1,680	0.3
SaD	Sarben loamy very fine sand, 6 to 9 percent slopes	1,050	0.2
SbB	Satanta very fine sandy loam, 1 to 3 percent slopes	1,020	0.2
SbC	Satanta very fine sandy loam, 3 to 6 percent slopes	990	0.2
Sc	Scott silt loam, 0 to 1 percent slopes	1,500	0.3
TaB	Tassel-Duda loamy sands, 0 to 3 percent slopes	5,170	0.9
TaF	Tassel-Duda loamy sands, 3 to 30 percent slopes	4,750	0.8
UsC2	Ulysses silt loam, 3 to 6 percent slopes, eroded	2,450	0.4
UsD2	Ulysses silt loam, 6 to 9 percent slopes, eroded	1,560	0.3
VaF	Valent sand, rolling	97,738	17.2
VaG	Valent sand, rolling and hilly	16,270	2.8
VcB	Valent loamy sand, 0 to 3 percent slopes	13,180	2.3
VcD	Valent loamy sand, 3 to 9 percent slopes	60,390	10.6
VeB	Vetal fine sandy loam, 0 to 3 percent slopes	5,410	0.9
Wa	Wann fine sandy loam, 0 to 2 percent slopes	2,620	0.5
WoB	Woodly loamy fine sand, 0 to 3 percent slopes	9,200	1.6
WpB	Woodly fine sandy loam, 0 to 3 percent slopes	18,740	3.3
	Water (areas of more than 40 acres)	2,432	0.4
	Total	572,160	100.0

* Less than 0.1 percent.

TABLE 5.--YIELDS PER ACRE OF CROPS

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Corn		Winter wheat		Alfalfa hay		Sugar beets		Dry pinto beans	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Ton	Ton	Ton	Ton	Lb	Lb
Ac-- Alliance	---	140	40	---	---	5.5	---	23	---	2,250
Af-- Altvan	---	120	27	---	---	4.5	---	18	---	1,900
AfB-- Altvan	---	115	24	---	---	4.3	---	18	---	1,850
AfC-- Altvan	---	105	22	---	---	4.0	---	13	---	1,600
AsB-- Ascalon	---	125	30	---	---	5.0	---	21	---	2,100
AsC-- Ascalon	---	115	29	---	---	5.0	---	18	---	1,900
BeB-- Blanche	---	105	15	---	---	4.0	---	---	---	---
Bg-- Bridget	---	135	34	---	---	5.5	---	20	---	2,100
BgB-- Bridget	---	130	32	---	---	5.3	---	19	---	2,050
BuC-- Bushman	---	115	24	---	---	4.5	---	---	---	---
Cb-- Caruso	---	115	25	---	3.0	5.0	---	---	---	---
ChD-- Colby	---	---	---	---	---	---	---	---	---	---
ChF-- Colby	---	---	---	---	---	---	---	---	---	---
ChG-- Colby	---	---	---	---	---	---	---	---	---	---
CrB-- Creighton	---	130	32	---	---	5.3	---	19	---	2,050
CrC-- Creighton	---	120	29	---	---	4.8	---	17	---	1,900
CrD-- Creighton	---	---	26	---	---	4.5	---	---	---	---
DbB-- Dailey	---	120	---	---	---	4.5	---	---	---	---
DuC-- Duda-Tassel	---	70	15	---	---	3.5	---	---	---	---
Fu. Fluvaquents										
Gb-- Gannett	---	---	---	---	---	---	---	---	---	---
Gf-- Gibbon	---	120	30	---	3.5	5.8	---	---	---	---

TABLE 5.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn		Winter wheat		Alfalfa hay		Sugar beets		Dry pinto beans	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Ton	Ton	Ton	Ton	Lb	Lb
Gh----------------------- Goshen	---	145	38	---	---	6.0	---	23	---	2,250
HaB---------------------- Haxtun	---	125	30	---	---	5.0	---	18	---	---
HdB---------------------- Haxtun	---	130	33	---	---	5.3	---	21	---	1,900
JaB---------------------- Jayem	---	120	22	---	---	4.5	---	---	---	---
JaC---------------------- Jayem	---	100	20	---	---	3.3	---	---	---	---
JcB---------------------- Jayem	---	125	26	---	---	4.5	---	17	---	1,900
JcC---------------------- Jayem	---	115	22	---	---	4.0	---	---	---	---
KeB---------------------- Keith	---	135	38	---	---	5.3	---	21	---	2,000
KeC2--------------------- Keith	---	120	32	---	---	4.5	---	18	---	1,800
Ku----------------------- Kuma	---	145	40	---	---	5.5	---	23	---	2,250
KuB---------------------- Kuma	---	140	38	---	---	5.3	---	21	---	2,200
KuC---------------------- Kuma	---	125	35	---	---	5.0	---	19	---	2,150
LaB---------------------- Laird	---	95	15	---	---	4.0	---	---	---	---
Ma----------------------- Mace	---	135	32	---	---	5.2	---	19	---	2,000
MaB---------------------- Mace	---	130	30	---	---	5.0	---	18	---	1,900
Mc----------------------- Mace-Alliance	---	136	33	---	---	5.3	---	20	---	2,050
McB---------------------- Mace-Alliance	---	127	31	---	---	5.1	---	18	---	1,900
Mm----------------------- McCash	---	130	38	---	2.5	4.8	---	---	---	---
Mo----------------------- McCook	---	135	35	---	2.8	6.0	---	20	---	2,100
Mp----------------------- McCook	---	130	35	---	2.5	6.0	---	19	---	2,050
MtB---------------------- McCook	---	---	---	---	---	---	---	---	---	---
OaF---------------------- Otero-Canyon	---	---	---	---	---	---	---	---	---	---

TABLE 5.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Corn		Winter wheat		Alfalfa hay		Sugar beets		Dry pinto beans	
	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Ton	Ton	Ton	Ton	Lb	Lb
OaG----------------------- Otero-Canyon	---	---	---	---	---	---	---	---	---	---
Rs------------------------ Rosebud	---	130	30	---	---	5.2	---	18	---	1,900
RsB----------------------- Rosebud	---	120	28	---	---	5.1	---	17	---	1,900
Rt------------------------ Rosebud-Canyon	---	115	15	---	---	4.8	---	15	---	1,800
RtB----------------------- Rosebud-Canyon	---	115	14	---	---	4.5	---	14	---	1,800
RtC----------------------- Rosebud-Canyon	---	110	22	---	---	4.0	---	13	---	1,600
RtD2---------------------- Rosebud-Canyon	---	95	20	---	---	3.5	---	10	---	1,500
SaC----------------------- Sarben	---	100	25	---	---	3.5	---	---	---	---
SaD----------------------- Sarben	---	95	22	---	---	3.2	---	---	---	---
SbB----------------------- Satanta	---	130	30	---	---	5.0	---	---	---	---
SbC----------------------- Satanta	---	130	30	---	---	5.0	---	---	---	---
Sc------------------------ Scott	---	---	10	---	---	---	---	---	---	---
TaB----------------------- Tassel-Duda	---	---	---	---	---	3.0	---	---	---	---
TaF----------------------- Tassel-Duda	---	---	---	---	---	---	---	---	---	---
UsC2---------------------- Ulysses	---	115	24	---	---	4.5	---	---	---	---
UsD2---------------------- Ulysses	---	100	22	---	---	3.5	---	---	---	---
VaF----------------------- Valent	---	---	---	---	---	---	---	---	---	---
VaG----------------------- Valent	---	---	---	---	---	---	---	---	---	---
VcB----------------------- Valent	---	100	---	---	---	3.5	---	15	---	---
VcD----------------------- Valent	---	90	---	---	---	3.0	---	---	---	---
VeB----------------------- Vetal	---	125	30	---	2.4	4.8	---	---	---	---
Wa------------------------ Wann	---	135	27	---	3.5	5.8	---	---	---	---
WoB----------------------- Woodly	---	125	30	---	---	5.0	---	18	---	1,900
WpB----------------------- Woodly	---	130	30	---	---	5.0	---	21	---	2,100

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[All soils are assigned to nonirrigated capability subclasses (N). Only potentially irrigable soils are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass) Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I (N)	---	---	---	---	---
(I)	98,060	---	---	---	---
II (N)	169,800	63,040	6,470	---	100,290
(I)	84,270	75,570	6,470	2,230	---
III (N)	85,790	51,370	---	34,420	---
(I)	83,940	49,520	---	34,420	---
IV (N)	42,660	39,360	1,500	1,800	---
(I)	113,362	106,392	---	6,970	---
V (N)	2,830	---	2,830	---	---
VI (N)	215,698	205,508	270	9,920	---
VII (N)	52,600	45,910	---	6,690	---
VIII(N)	350	---	---	350	---

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Ac: Alliance	Silty	Favorable	3,500	Blue grama	20
		Normal	2,500	Little bluestem	15
		Unfavorable	1,700	Western wheatgrass	15
				Buffalograss	10
				Needleandthread	10
				Sand dropseed	5
				Sedge	5
Af, AfB, AfC: Altvan	Silty	Favorable	3,300	Western wheatgrass	20
		Normal	2,300	Needleandthread	20
		Unfavorable	1,500	Blue grama	15
				Threadleaf sedge	15
				Green needlegrass	10
				Little bluestem	5
				Sideoats grama	5
				Buffalograss	5
AsB, AsC: Ascalon	Sandy	Favorable	3,200	Blue grama	25
		Normal	2,500	Sand bluestem	15
		Unfavorable	1,500	Western wheatgrass	10
				Needleandthread	10
				Little bluestem	8
				Prairie sandreed	5
				Sand dropseed	5
				Sedge	5
BeB: Blanche	Sandy	Favorable	2,800	Needleandthread	20
		Normal	2,300	Blue grama	15
		Unfavorable	1,500	Prairie sandreed	15
				Sand bluestem	15
				Little bluestem	10
				Sand sagebrush	5
				Sand dropseed	5
				Sedge	5
Bg, BgB: Bridget	Silty	Favorable	3,300	Western wheatgrass	15
		Normal	2,300	Blue grama	15
		Unfavorable	1,500	Needleandthread	10
				Threadleaf sedge	10
				Little bluestem	10
				Buffalograss	5
				Big bluestem	5
				Sideoats grama	5
				Plains muhly	5
BuC: Bushman	Limy Upland	Favorable	2,500	Blue grama	25
		Normal	2,000	Big bluestem	20
		Unfavorable	1,000	Little bluestem	15
				Sideoats grama	10
				Western wheatgrass	10
				Needleandthread	10
				Threadleaf sedge	5
Cb: Caruso	Saline Subirrigated	Favorable	3,800	Little bluestem	20
		Normal	3,000	Alkali sacaton	20
		Unfavorable	2,200	Switchgrass	15
				Indiangrass	10
				Western wheatgrass	10
				Sedge	10
				Inland saltgrass	5
				Buffalograss	5
				Plains bluegrass	5

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
ChD, ChF: Colby	Limy Upland	Favorable	2,700	Little bluestem	25
		Normal	2,200	Sideoats grama	20
		Unfavorable	1,500	Blue grama	10
				Western wheatgrass	10
				Big bluestem	10
				Needleandthread	10
				Small soapweed	5
				Plains muhly	5
				Threadleaf sedge	5
ChG: Colby	Thin Loess	Favorable	2,500	Little bluestem	30
		Normal	2,000	Sideoats grama	15
		Unfavorable	1,200	Blue grama	10
				Western wheatgrass	10
				Big bluestem	10
				Small soapweed	5
CrB, CrC, CrD: Creighton	Silty	Favorable	3,000	Western wheatgrass	35
		Normal	2,200	Needleandthread	15
		Unfavorable	1,500	Blue grama	10
				Little bluestem	5
				Prairie junegrass	5
				Threadleaf sedge	5
DbB: Dailey	Sandy	Favorable	2,800	Prairie sandreed	20
		Normal	2,000	Blue grama	15
		Unfavorable	1,500	Needleandthread	15
				Sand sagebrush	10
				Sand bluestem	5
				Sand dropseed	5
				Sedge	5
				Little bluestem	5
DuC*:					
Duda	Sandy	Favorable	2,500	Sand bluestem	35
		Normal	2,000	Prairie sandreed	20
		Unfavorable	1,000	Little bluestem	10
				Needleandthread	10
				Blue grama	10
				Sedge	5
				Sand dropseed	5
				Sand sagebrush	5
Tassel	Shallow Limy	Favorable	1,500	Needleandthread	20
		Normal	1,300	Little bluestem	15
		Unfavorable	700	Threadleaf sedge	15
				Prairie sandreed	10
				Sand bluestem	10
				Blue grama	5
				Sideoats grama	5
				Plains muhly	5
Gb: Gannett	Wetland	Favorable	5,500	Prairie cordgrass	40
		Normal	5,000	Reedgrass	20
		Unfavorable	4,500	Sedge	15
				Slender wheatgrass	10
				Plains bluegrass	5
Gf: Gibbon	Subirrigated	Favorable	5,000	Big bluestem	25
		Normal	4,500	Little bluestem	15
		Unfavorable	3,700	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	10
				Sedge	10
				Kentucky bluegrass	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Gh: Goshen	Silty	Favorable	3,500	Blue grama	20
		Normal	2,500	Western wheatgrass	20
		Unfavorable	1,700	Little bluestem	15
				Buffalograss	10
				Needleandthread	10
				Big bluestem	5
				Sideoats grama	5
				Sedge	5
HaB, HdB: Haxtun	Sandy	Favorable	3,200	Blue grama	15
		Normal	2,500	Needleandthread	15
		Unfavorable	1,700	Prairie sandreed	15
				Little bluestem	10
				Sand bluestem	10
				Prairie junegrass	5
				Red threeawn	5
				Sand dropseed	5
				Sedge	5
JaB, JaC, JcB, JcC: Jayem	Sandy	Favorable	3,200	Blue grama	15
		Normal	2,500	Needleandthread	15
		Unfavorable	1,700	Little bluestem	10
				Sand bluestem	10
				Prairie junegrass	5
				Red threeawn	5
				Sand dropseed	5
				Sedge	5
				Sand sagebrush	5
KeB, KeC2: Keith	Silty	Favorable	3,200	Western wheatgrass	20
		Normal	2,300	Blue grama	20
		Unfavorable	1,500	Needleandthread	10
				Buffalograss	10
				Little bluestem	10
				Sedge	5
				Big bluestem	5
				Sideoats grama	5
Ku, KuB, KuC: Kuma	Silty	Favorable	3,200	Blue grama	60
		Normal	2,300	Buffalograss	10
		Unfavorable	1,500	Western wheatgrass	10
				Needlegrass	5
LaB: Laird	Saline Lowland	Favorable	2,000	Alkali sacaton	25
		Normal	1,500	Switchgrass	20
		Unfavorable	700	Inland saltgrass	15
				Western wheatgrass	10
				Blue grama	10
				Indiangrass	5
				Sedge	5
Ma, MaB: Mace	Silty	Favorable	3,000	Blue grama	20
		Normal	2,300	Western wheatgrass	20
		Unfavorable	1,500	Little bluestem	10
				Needleandthread	10
				Threadleaf sedge	10
				Prairie sandreed	5
				Big bluestem	5
				Sideoats grama	5
				Buffalograss	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Mc*, McB*:					
Mace	Silty	Favorable	3,000	Blue grama	20
		Normal	2,300	Western wheatgrass	20
		Unfavorable	1,500	Little bluestem	10
				Needleandthread	10
				Threadleaf sedge	10
				Prairie sandreed	5
				Big bluestem	5
				Sideoats grama	5
				Buffalograss	5
Alliance	Silty	Favorable	3,500	Blue grama	20
		Normal	2,500	Little bluestem	15
		Unfavorable	1,700	Western wheatgrass	15
				Buffalograss	10
				Needleandthread	10
				Sand dropseed	5
				Sedge	5
Mm McCash	Silty	Favorable	3,700	Western wheatgrass	20
		Normal	3,300	Blue grama	15
		Unfavorable	2,200	Little bluestem	10
				Buffalograss	10
				Big bluestem	5
				Sand dropseed	5
				Needleandthread	5
				Sideoats grama	5
				Sedge	5
Mo, Mp McCook	Silty Lowland	Favorable	3,800	Big bluestem	25
		Normal	3,300	Little bluestem	15
		Unfavorable	2,200	Switchgrass	10
				Indiangrass	10
				Western wheatgrass	10
				Canada wildrye	5
				Sedge	5
				Blue grama	5
				Sideoats grama	5
MtB McCook	Silty Overflow	Favorable	3,300	Big bluestem	25
		Normal	2,800	Western wheatgrass	25
		Unfavorable	2,000	Little bluestem	10
				Sideoats grama	10
				Switchgrass	5
				Sedge	5
				Blue grama	5
OaF*, OaG*:					
Otero	Limy Upland	Favorable	2,500	Little bluestem	20
		Normal	2,000	Blue grama	15
		Unfavorable	1,500	Prairie sandreed	10
				Threadleaf sedge	10
				Needleandthread	10
				Sand dropseed	5
				Western wheatgrass	5
				Sand bluestem	5
				Plains muhly	5
Canyon	Shallow Limy	Favorable	1,500	Little bluestem	20
		Normal	1,300	Threadleaf sedge	15
		Unfavorable	700	Sideoats grama	15
				Big bluestem	10
				Blue grama	5
				Hairy grama	5
				Plains muhly	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
Rs, RsB: Rosebud	Silty	Favorable	2,800	Little bluestem	20
		Normal	2,000	Needleandthread	15
		Unfavorable	1,200	Blue grama	15
				Big bluestem	10
				Threadleaf sedge	10
				Sideoats grama	5
				Prairie sandreed	5
				Buffalograss	5
				Sand dropseed	5
Rt*, RtB*, RtC*, RtD2*:					
Rosebud	Silty	Favorable	2,800	Little bluestem	20
		Normal	2,000	Needleandthread	15
		Unfavorable	1,200	Blue grama	15
				Big bluestem	10
				Threadleaf sedge	10
				Sideoats grama	5
				Prairie sandreed	5
				Buffalograss	5
				Sand dropseed	5
Canyon	Shallow Limy	Favorable	1,500	Little bluestem	20
		Normal	1,300	Threadleaf sedge	15
		Unfavorable	700	Sideoats grama	15
				Big bluestem	10
				Blue grama	5
				Hairy grama	5
				Plains muhly	5
SaC, SaD: Sarben	Sandy	Favorable	2,500	Prairie sandreed	20
		Normal	2,000	Needleandthread	20
		Unfavorable	1,500	Little bluestem	15
				Blue grama	10
				Sand bluestem	10
				Sand sagebrush	5
				Western wheatgrass	5
				Sedge	5
SbB, SbC: Satanta	Silty	Favorable	2,700	Prairie sandreed	20
		Normal	2,000	Blue grama	20
		Unfavorable	1,500	Needleandthread	20
				Little bluestem	15
				Sand bluestem	10
				Western wheatgrass	5
				Sand dropseed	5
				Sand sagebrush	5
TaB*, TaF*:					
Tassel	Shallow Limy	Favorable	1,500	Needleandthread	20
		Normal	1,300	Little bluestem	15
		Unfavorable	700	Threadleaf sedge	15
				Prairie sandreed	10
				Sand bluestem	10
				Blue grama	5
				Sideoats grama	5
				Plains muhly	5
Duda	Sandy	Favorable	2,500	Needleandthread	20
		Normal	2,000	Prairie sandreed	20
		Unfavorable	1,500	Little bluestem	15
				Sand bluestem	10
				Sedge	5
				Sand dropseed	5
				Blue grama	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
UsC2, UsD2 Ulysses	Silty	Favorable	3,000	Blue grama	20
		Normal	2,000	Western wheatgrass	15
		Unfavorable	1,500	Sideoats grama	10
				Little bluestem	10
				Buffalograss	10
				Big bluestem	10
VaF Valent	Sands	Favorable	3,000	Prairie sandreed	25
		Normal	2,200	Sand bluestem	15
		Unfavorable	1,700	Needleandthread	15
				Blue grama	10
				Needlegrass	10
				Little bluestem	5
				Sand dropseed	5
				Switchgrass	5
				Sand sagebrush	5
VaG Valent	Sands-Choppy Sands	Favorable	3,000	Prairie sandreed	25
		Normal	2,200	Sand bluestem	15
		Unfavorable	1,700	Little bluestem	15
				Blue grama	10
				Needleandthread	10
				Sand dropseed	5
				Switchgrass	5
				Sand sagebrush	5
VcB Valent	Sandy	Favorable	2,500	Prairie sandreed	20
		Normal	2,000	Sand bluestem	15
		Unfavorable	1,500	Needleandthread	15
				Blue grama	10
				Little bluestem	5
				Sand dropseed	5
				Sand sagebrush	5
VcD Valent	Sands	Favorable	2,500	Prairie sandreed	20
		Normal	2,000	Sand bluestem	15
		Unfavorable	1,200	Needleandthread	15
				Little bluestem	15
				Blue grama	10
				Sand dropseed	5
				Sideoats grama	5
				Switchgrass	5
				Sand sagebrush	5
VeB Vetal	Sandy	Favorable	3,000	Prairie sandreed	15
		Normal	2,700	Needleandthread	15
		Unfavorable	1,700	Blue grama	15
				Little bluestem	10
				Sand bluestem	10
				Western wheatgrass	5
				Sedge	5
Wa Wann	Subirrigated	Favorable	5,300	Big bluestem	30
		Normal	4,500	Little bluestem	15
		Unfavorable	3,700	Indiangrass	15
				Switchgrass	10
				Prairie cordgrass	10
				Sedge	10
				Kentucky bluegrass	5
WoB, WpB Woodly	Sandy	Favorable	3,000	Little bluestem	40
		Normal	2,500	Prairie sandreed	15
		Unfavorable	1,700	Needleandthread	15
				Blue grama	15
				Sand bluestem	10
				Sedge	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Ac----------------- Alliance	Skunkbush sumac, lilac, American plum.	Rocky Mountain juniper, Russian-olive, Siberian peashrub, common hackberry.	Eastern redcedar, ponderosa pine, honeylocust, green ash.	Siberian elm------	---
Af, AfB, AfC------ Altvan	Skunkbush sumac, lilac, Siberian peashrub, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, common hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
AsB, AsC---------- Ascalon	Lilac, common chokecherry, American plum, Amur honeysuckle.	Rocky Mountain juniper, Russian mulberry.	Siberian elm, ponderosa pine, common hackberry, eastern redcedar, green ash, honeylocust.	---	---
BeB--------------- Blanche	Skunkbush sumac, lilac, Peking cotoneaster, Amur honeysuckle.	Rocky Mountain juniper, eastern redcedar, common hackberry, green ash, Russian-olive.	Ponderosa pine, Siberian elm, honeylocust.	---	---
Bg, BgB----------- Bridget	Lilac, American plum.	Rocky Mountain juniper, common chokecherry, Manchurian crabapple, Siberian peashrub.	Common hackberry, ponderosa pine, Russian-olive, green ash, honeylocust.	Siberian elm------	---
BuC--------------- Bushman	Siberian peashrub, silver buffaloberry, skunkbush sumac, Tatarian honeysuckle.	Eastern redcedar, Rocky Mountain juniper, ponderosa pine, green ash, Russian-olive, black locust.	Honeylocust, Siberian elm.	---	---
Cb---------------- Caruso	Silver buffaloberry, Tatarian honeysuckle, Siberian peashrub, lilac.	Russian-olive, eastern redcedar, Rocky Mountain juniper, green ash.	Siberian elm, golden willow.	---	Eastern cottonwood.
ChD--------------- Colby	Siberian peashrub, fragrant sumac, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, Russian-olive, ponderosa pine, Rocky Mountain juniper, green ash, black locust.	Siberian elm, honeylocust.	---	---
ChF, ChG. Colby					
CrB, CrC, CrD----- Creighton	American plum, lilac.	Rocky Mountain juniper, Manchurian crabapple, Siberian peashrub, common chokecherry.	Common hackberry, Russian-olive, ponderosa pine, green ash, honeylocust.	Siberian elm------	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
DbB---------------- Dailey	Common chokecherry, American plum, lilac, Tatarian honeysuckle.	Rocky Mountain juniper, Siberian peashrub, Russian-olive, Manchurian crabapple.	Ponderosa pine, green ash, honeylocust.	Siberian elm------	---
DuC*: Duda-------------	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine.	---	---
Tassel.					
Fu*. Fluvaquents					
Gb. Gannett					
Gf----------------- Gibbon	Redosier dogwood, American plum, lilac.	Common chokecherry.	Eastern redcedar, common hackberry, ponderosa pine, Russian mulberry.	Green ash, honeylocust, golden willow.	Eastern cottonwood.
Gh----------------- Goshen	Lilac, American plum.	Tatarian honeysuckle.	Eastern redcedar, blue spruce, ponderosa pine, green ash, common hackberry, Russian-olive.	Honeylocust, Siberian elm.	Eastern cottonwood.
HaB, HdB---------- Haxtun	American plum, common chokecherry, lilac, Amur honeysuckle.	Rocky Mountain juniper, Russian mulberry.	Eastern redcedar, honeylocust, common hackberry, ponderosa pine, green ash.	Siberian elm------	---
JaB, JaC, JcB, JcC-------------- Jayem	Tatarian honey-suckle, lilac, American plum.	Rocky Mountain juniper, Russian-olive, common chokecherry, Siberian peashrub, Manchurian crab-apple.	Ponderosa pine, honeylocust, green ash.	Siberian elm------	---
KeB, KeC2--------- Keith	Lilac, American plum.	Rocky Mountain juniper, Manchurian crabapple, common chokecherry, Siberian peashrub.	Common hackberry, ponderosa pine, green ash, honeylocust, Russian-olive.	Siberian elm------	---
Ku, KuB, KuC------ Kuma	Fragrant sumac, lilac, Amur honeysuckle.	Russian-olive, common chokecherry.	Eastern redcedar, green ash, ponderosa pine, honeylocust, bur oak.	Siberian elm------	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
LaB-------- Laird	Eastern redcedar, Rocky Mountain juniper, silver buffaloberry, Tatarian honeysuckle, lilac, Siberian peashrub.	Ponderosa pine, green ash, Siberian elm, Russian-olive.	---	---	---
Ma, MaB-------- Mace	Skunkbush sumac, Siberian peashrub, Peking cotoneaster, lilac.	Common hackberry, Rocky Mountain juniper, Russian-olive, eastern redcedar, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
Mc*, McB*:					
Mace--------	Skunkbush sumac, Siberian peashrub, Peking cotoneaster, lilac.	Common hackberry, Rocky Mountain juniper, Russian-olive, eastern redcedar, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
Alliance--------	Skunkbush sumac, lilac, American plum.	Rocky Mountain juniper, Russian-olive, Siberian peashrub, common hackberry.	Eastern redcedar, ponderosa pine, honeylocust, green ash.	Siberian elm------	---
Mm-------- McCash	Lilac, American plum.	---	Russian-olive, common hackberry, green ash, honeylocust, ponderosa pine, eastern redcedar, Rocky Mountain juniper.	Siberian elm, honeysuckle.	Eastern cottonwood.
Mo-------- McCook	American plum, lilac.	Tatarian honeysuckle.	Eastern redcedar, ponderosa pine, common hackberry, green ash, Russian-olive, Rocky Mountain juniper.	Honeylocust, Siberian elm.	Eastern cottonwood.
Mp-------- McCook	American plum, lilac.	Tatarian honeysuckle.	Eastern redcedar, ponderosa pine, Russian-olive, common hackberry, green ash, Rocky Mountain juniper.	Honeylocust, Siberian elm.	Eastern cottonwood.
MtB. McCook					
OaF*, OaG*: Otero.					
Canyon.					
Rs, RsB-------- Rosebud	Skunkbush sumac, Siberian peashrub, lilac, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, common hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- <8	8-15	16-25	26-35	>35
Rt*, RtB*, RtC*, RtD2*:					
Rosebud	Skunkbush sumac, Siberian peashrub, lilac, Peking cotoneaster.	Eastern redcedar, Rocky Mountain juniper, Russian-olive, common hackberry, green ash.	Ponderosa pine, Siberian elm, honeylocust.	---	---
Canyon.					
SaC Sarben	Amur honeysuckle, American plum, common chokecherry, lilac.	Russian mulberry, Rocky Mountain juniper.	Eastern redcedar, ponderosa pine, common hackberry, green ash, honeylocust.	Siberian elm	---
SaD Sarben	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine	---	---
SbB, SbC Satanta	Fragrant sumac, lilac, Amur honeysuckle.	Russian-olive, common chokecherry.	Eastern redcedar, honeylocust, ponderosa pine, green ash, common hackberry, bur oak.	Siberian elm	---
Sc. Scott					
TaB*, TaF*:					
Tassel.					
Duda	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine, Austrian pine.	---	---
UsC2, UsD2 Ulysses	Fragrant sumac, Siberian peashrub, silver buffaloberry, Tatarian honeysuckle.	Eastern redcedar, ponderosa pine, Russian-olive, green ash, Rocky Mountain juniper, black locust.	Honeylocust, Siberian elm.	---	---
VaF Valent	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine	---	---
VaG. Valent					
VcB, VcD Valent	---	Eastern redcedar, Rocky Mountain juniper.	Ponderosa pine	---	---
VeB Vetal	Skunkbush sumac, lilac, Tatarian honeysuckle.	Russian-olive, Manchurian crabapple, eastern redcedar, Siberian peashrub.	Ponderosa pine, common hackberry, green ash, honeylocust.	Siberian elm	---
Wa Wann	Skunkbush sumac	Siberian peashrub, lilac, Tatarian honeysuckle, Manchurian crabapple.	Eastern redcedar, ponderosa pine, common hackberry.	Green ash, honeylocust, golden willow.	Eastern cottonwood.

See footnote at end of table.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
WoB, WpB----------- Woodly	Lilac, American plum, Tatarian honeysuckle.	Rocky Mountain juniper, Siberian peashrub, common chokecherry, Russian-olive, Manchurian crabapple.	Honeylocust, green ash, ponderosa pine.	Siberian elm------	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Ac: Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
Af: Altvan	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
AfB, AfC: Altvan	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
AsB, AsC: Ascalon	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
BeB: Blanche	Moderate: dusty.	Moderate: dusty.	Slight	Moderate: dusty.	Moderate: thin layer.
Bg: Bridget	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
BgB: Bridget	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
BuC: Bushman	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
Cb: Caruso	Severe: flooding, excess sodium, excess salts.	Severe: excess sodium, excess salts.	Severe: excess sodium, excess salts.	Slight	Severe: excess salts, excess sodium.
ChD: Colby	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Severe: erodes easily.	Slight.
ChF: Colby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
ChG: Colby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
CrB, CrC: Creighton	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Severe: erodes easily.	Slight.
CrD: Creighton	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
DbB: Dailey	Slight	Slight	Slight	Slight	Severe: droughty.
DuC*:					
Duda	Slight	Slight	Moderate: slope, depth to rock.	Slight	Moderate: droughty, thin layer.
Tassel	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Severe: thin layer.
Fu*. Fluvaquents					

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Gb: Gannett	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
Gf: Gibbon	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.	Moderate: wetness, flooding.
Gh: Goshen	Severe: flooding.	Slight	Slight	Slight	Slight.
HaB, HdB: Haxtun	Slight	Slight	Moderate: small stones.	Slight	Slight.
JaB: Jayem	Slight	Slight	Moderate: small stones.	Slight	Slight.
JaC: Jayem	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
JcB: Jayem	Slight	Slight	Moderate: small stones.	Slight	Slight.
JcC: Jayem	Slight	Slight	Moderate: slope, small stones.	Slight	Slight.
KeB, KeC2: Keith	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
Ku: Kuma	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
KuB, KuC: Kuma	Moderate: dusty.	Moderate: dusty.	Moderate: dusty, slope.	Moderate: dusty.	Slight.
LaB: Laird	Severe: excess sodium, excess salts.	Severe: excess sodium, excess salts.	Severe: excess sodium, excess salts.	Slight	Severe: excess salts, excess sodium.
Ma: Mace	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: thin layer.
MaB: Mace	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock, dusty.	Moderate: dusty.	Moderate: thin layer.
Mc*:					
Mace	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: thin layer.
Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Slight.
McB*:					
Mace	Moderate: dusty.	Moderate: dusty.	Moderate: slope, depth to rock, dusty.	Moderate: dusty.	Moderate: thin layer.
Alliance	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
Mm: McCash	Slight	Slight	Slight	Slight	Slight.
Mo: McCook	Severe: flooding.	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Mp: McCook	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
MtB: McCook	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
OaF*:					
Otero	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: dusty.	Severe: thin layer.
OaG*:					
Otero	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Canyon	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope, thin layer.
Rs: Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: small stones.	Moderate: dusty.	Moderate: thin layer.
RsB: Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, depth to rock.	Moderate: dusty.	Moderate: thin layer.
Rt*, RtB*:					
Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: small stones.	Moderate: dusty.	Moderate: thin layer.
Canyon.					
RtC*:					
Rosebud	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, depth to rock.	Moderate: dusty.	Moderate: thin layer.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: dusty.	Severe: thin layer.
RtD2*:					
Rosebud	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.	Moderate: slope, thin layer.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Moderate: dusty.	Severe: thin layer.
SaC: Sarben	Slight	Slight	Moderate: slope.	Slight	Slight.
SaD: Sarben	Slight	Slight	Severe: slope.	Slight	Slight.
SbB, SbC: Satanta	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
Sc: Scott	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, erodes easily.	Severe: ponding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
TaB*:					
Tassel.					
Duda	Slight	Slight	Slight	Slight	Moderate: droughty, thin layer.
TaF*:					
Tassel	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
Duda	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope, thin layer.
UsC2 Ulysses	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.	Slight.
UsD2 Ulysses	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.	Slight.
VaF Valent	Severe: too sandy.	Severe: too sandy.	Severe: slope, too sandy.	Severe: too sandy.	Moderate: droughty, slope, too sandy.
VaG Valent	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: slope, too sandy.	Severe: too sandy, slope.	Severe: slope.
VcB Valent	Slight	Slight	Slight	Slight	Moderate: droughty.
VcD Valent	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
VeB Vetal	Slight	Slight	Slight	Slight	Slight.
Wa Wann	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.	Moderate: wetness, flooding.
WoB, WpB Woodly	Slight	Slight	Slight	Slight	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ac-----------------Alliance	Good	Good	Good	Good	Good	Fair	Very poor.	Poor	Good	Good	Poor	Good.
Af-----------------Altvan	Good	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
AfB, AfC-----------Altvan	Fair	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
AsB----------------Ascalon	Good	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
AsC----------------Ascalon	Fair	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
BeB----------------Blanche	Fair	Good	Good	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
Bg, BgB------------Bridget	Good	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	Good.
BuC----------------Bushman	Fair	Good	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
Cb-----------------Caruso	Fair	Fair	Good	Poor	Poor	Fair	Fair	Fair	Fair	Poor	Fair	Fair.
ChD, ChF, ChG------Colby	Poor	Fair	Fair	Fair	Fair	Poor	Very poor.	Very poor.	Fair	Fair	Very poor.	Poor.
CrB----------------Creighton	Good	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
CrC, CrD-----------Creighton	Fair	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
DbB----------------Dailey	Poor	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair.
DuC*:												
Duda----------------	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
Tassel-------------	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Fu*. Fluvaquents												
Gb-----------------Gannett	Very poor.	Poor	Fair	Poor	Poor	Fair	Good	Good	Poor	Poor	Good	Fair.
Gf-----------------Gibbon	Good	Good	Good	Good	Fair	Good	Fair	Good	Good	Good	Fair	Good.
Gh-----------------Goshen	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
HaB----------------- Haxtun	Fair	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
HdB----------------- Haxtun	Good	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
JaB, JaC, JcB, JcC Jayem	Fair	Good	Good	Good	Good	Fair	Very poor.	Very poor.	Good	Good	Very poor.	Good.
KeB----------------- Keith	Good	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
KeC2---------------- Keith	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
Ku, KuB, KuC-------- Kuma	Good	Good	Fair	Good	Good	Fair	Poor	Very poor.	Fair	Good	Very poor.	Poor.
LaB----------------- Laird	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Poor	Poor.
Ma, MaB------------- Mace	Good	Good	Fair	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
Mc*, McB*:												
Mace---------------	Good	Good	Fair	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	Fair.
Alliance-----------	Good	Good	Good	Good	Good	Fair	Very poor.	Poor	Good	Good	Poor	Good.
Mm------------------ McCash	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
Mo, Mp-------------- McCook	Good	Good	Good	Good	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
MtB----------------- McCook	Poor	Poor	Fair	Good	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Good.
OaF*:												
Otero--------------	Poor	Fair	Good	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Canyon-------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
OaG*:												
Otero--------------	Poor	Poor	Good	Good	Good	Fair	Very poor.	Very poor.	Poor	Good	Very poor.	Fair.
Canyon-------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
Rs------------------ Rosebud	Good	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
RsB----------------- Rosebud	Good	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Rt*:												
Rosebud------------	Good	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Canyon-------------	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
RtB*:												
Rosebud------------	Good	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
RtB*:												
Canyon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
RtC*, RtD2*:												
Rosebud	Fair	Good	Fair	Good	Good	Fair	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
Canyon	Poor	Poor	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Poor.
SaC, SaD Sarben	Fair	Good	Good	Fair	Fair	Good	Very poor.	Very poor.	Good	Fair	Very poor.	Good.
SbB, SbC Satanta	Good	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	Good.
Sc Scott	Poor	Fair	Fair	Fair	Fair	Poor	Good	Good	Fair	Fair	Good	Fair.
TaB*:												
Tassel	Poor	Poor	Poor	Fair	Fair	Good	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Duda	Poor	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Fair.
TaF*:												
Tassel	Poor	Poor	Poor	Fair	Fair	Poor	Very poor.	Very poor.	Poor	Fair	Very poor.	Poor.
Duda	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Fair.
UsC2 Ulysses	Fair	Good	Fair	Good	Good	Poor	Poor	Poor	Fair	Good	Poor	Fair.
UsD2 Ulysses	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Very poor.	Fair	Good	Very poor.	Fair.
VaF Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VaG Valent	Very poor.	Very poor.	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.	Fair.
VcB, VcD Valent	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.	Fair.
VeB Vetal	Fair	Fair	Good	Fair	Very poor.	Fair	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good.
Wa Wann	Good	Good	Good	Good	Fair	Good	Poor	Fair	Good	Good	Fair	Good.
WoB, WpB Woodly	Fair	Fair	Good	Fair	Very poor.	Fair	Very poor.	Very poor.	Fair	Very poor.	Very poor.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Ac----------------- Alliance	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Moderate: frost action.	Slight.
Af, AfB, AfC------ Altvan	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Moderate: frost action.	Slight.
AsB---------------- Ascalon	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Moderate: frost action.	Moderate: droughty.
AsC---------------- Ascalon	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
BeB---------------- Blanche	Severe: cutbanks cave.	Slight----------	Moderate: depth to rock.	Slight----------	Slight----------	Moderate: thin layer.
Bg, BgB------------ Bridget	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: frost action.	Slight.
BuC---------------- Bushman	Slight----------	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
Cb----------------- Caruso	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength, flooding.	Severe: excess salts, excess sodium.
ChD---------------- Colby	Slight----------	Slight----------	Slight----------	Moderate: slope.	Severe: low strength.	Slight.
ChF, ChG----------- Colby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
CrB---------------- Creighton	Slight----------	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
CrC---------------- Creighton	Slight----------	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
CrD---------------- Creighton	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
DbB---------------- Dailey	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight----------	Severe: droughty.
DuC*:						
Duda--------------	Severe: cutbanks cave.	Slight----------	Moderate: depth to rock.	Moderate: slope.	Slight----------	Moderate: droughty, thin layer.
Tassel------------	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: thin layer.
Fu* Fluvaquents						
Gb----------------- Gannett	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
Gf----------------- Gibbon	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: wetness, flooding.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
Gh----------------- Goshen	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.
HaB, HdB---------- Haxtun	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
JaB--------------- Jayem	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
JaC--------------- Jayem	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
JcB--------------- Jayem	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
JcC--------------- Jayem	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
KeB--------------- Keith	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: low strength.	Slight.
KeC2-------------- Keith	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
Ku, KuB----------- Kuma	Slight---------	Slight---------	Slight---------	Slight---------	Severe: low strength.	Slight.
KuC--------------- Kuma	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: low strength.	Slight.
LaB--------------- Laird	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Severe: excess salts, excess sodium.
Ma, MaB----------- Mace	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: thin layer.
Mc*, McB*:						
Mace--------------	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: thin layer.
Alliance----------	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
Mm---------------- McCash	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Moderate: frost action.	Slight.
Mo---------------- McCook	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.	Slight.
Mp---------------- McCook	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
MtB--------------- McCook	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
OaF*:						
Otero-------------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
Canyon------------	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: thin layer.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
OaG*:						
Otero	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Canyon	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Rs, RsB Rosebud	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Moderate: frost action.	Moderate: thin layer.
Rt*, RtB*:						
Rosebud	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Slight	Moderate: frost action.	Moderate: thin layer.
Canyon	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: thin layer.
RtC*:						
Rosebud	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.	Moderate: thin layer.
Canyon	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: thin layer.
RtD2*:						
Rosebud	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer.
Canyon	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Severe: thin layer.
SaC, SaD Sarben	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Slight.
SbB Satanta	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
SbC Satanta	Slight	Slight	Slight	Moderate: slope.	Moderate: frost action.	Slight.
Sc Scott	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, frost action.	Severe: ponding.
TaB*:						
Tassel	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: thin layer.
Duda	Severe: cutbanks cave.	Slight	Moderate: depth to rock.	Slight	Slight	Moderate: droughty, thin layer.
TaF*:						
Tassel	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, thin layer.
Duda	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope, thin layer.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
UsC2, UsD2: Ulysses	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
VaF: Valent	Severe: cutbanks cave, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, too sandy.
VaG: Valent	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
VcB: Valent	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
VcD: Valent	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
VeB: Vetal	Slight	Slight	Slight	Slight	Moderate: frost action.	Slight.
Wa: Wann	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, frost action.	Moderate: wetness, flooding.
WoB, WpB: Woodly	Slight	Moderate: shrink-swell.	Slight	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ac------------------- Alliance	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim, thin layer.
Af, AfB, AfC-------- Altvan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
AsB, AsC------------ Ascalon	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
BeB----------------- Blanche	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim.
Bg------------------ Bridget	Slight-----------	Moderate: seepage.	Slight-----------	Slight-----------	Good.
BgB----------------- Bridget	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
BuC----------------- Bushman	Slight-----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Cb------------------ Caruso	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness, excess sodium.	Severe: flooding, wetness.	Poor: excess sodium.
ChD----------------- Colby	Slight-----------	Severe: slope.	Slight-----------	Slight-----------	Good.
ChF, ChG------------ Colby	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
CrB, CrC------------ Creighton	Moderate: percs slowly.	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
CrD----------------- Creighton	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
DbB----------------- Dailey	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
DuC*:					
Duda----------------	Severe: depth to rock, poor filter.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim.
Tassel--------------	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Fu*. Fluvaquents					

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Gb: Gannett	Severe: ponding, poor filter.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: seepage, ponding.	Poor: seepage, too sandy, ponding.
Gf: Gibbon	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
Gh: Goshen	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
HaB, HdB: Haxtun	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too clayey.
JaB, JaC, JcB, JcC: Jayem	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
KeB, KeC2: Keith	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Ku: Kuma	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
KuB, KuC: Kuma	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Good.
LaB: Laird	Severe: poor filter.	Severe: seepage.	Severe: seepage, excess sodium, excess salts.	Severe: seepage.	Poor: excess salts, excess sodium.
Ma, MaB: Mace	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Mc*:					
Mace	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Alliance	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim, thin layer.
McB*:					
Mace	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Alliance	Moderate: depth to rock, percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: area reclaim, thin layer.
Mm: McCash	Moderate: percs slowly.	Moderate: seepage.	Moderate: too sandy.	Slight	Good.
Mo: McCook	Moderate: flooding, percs slowly.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Good.
Mp, MtB: McCook	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
OaF*:					
Otero	Moderate: slope.	Severe: seepage, slope.	Moderate: slope, too sandy.	Moderate: slope.	Fair: slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
OaF*:					
Canyon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
OaG*:					
Otero	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope.
Canyon	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Rs, RsB Rosebud	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Rt*, RtB*:					
Rosebud	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
RtC*:					
Rosebud	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
RtD2*:					
Rosebud	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Canyon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
SaC Sarben	Slight	Severe: seepage.	Moderate: too sandy.	Slight	Good.
SaD Sarben	Slight	Severe: seepage, slope.	Moderate: too sandy.	Slight	Good.
SbB, SbC Satanta	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Sc Scott	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
TaB*:					
Tassel	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
Duda	Severe: depth to rock, poor filter.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
TaF*:					
Tassel	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
Duda	Severe: depth to rock, poor filter.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim.
UsC2 Ulysses	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
UsD2 Ulysses	Moderate: slope.	Severe: slope.	Slight	Slight	Good.
VaF Valent	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: too sandy.
VaG Valent	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: slope, too sandy.	Severe: slope.	Poor: too sandy, slope.
VcB, VcD Valent	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Slight	Poor: too sandy.
VeB Vetal	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Wa Wann	Severe: flooding, wetness.	Severe: seepage, wetness, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Fair: wetness.
WoB, WpB Woodly	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ac: Alliance	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Af, AfB, AfC: Altvan	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
AsB, AsC: Ascalon	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
BeB: Blanche	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Bg, BgB: Bridget	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
BuC: Bushman	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Cb: Caruso	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salts, excess sodium.
ChD: Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
ChF: Colby	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
ChG: Colby	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
CrB, CrC: Creighton	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
CrD: Creighton	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
DbB: Dailey	Good	Probable	Improbable: too sandy.	Fair: too sandy.
DuC*:				
Duda	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too sandy, thin layer.
Tassel	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Fu*. Fluvaquents				
Gb: Gannett	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
Gf: Gibbon	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Gh: Goshen	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
HaB: Haxtun	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones, area reclaim.
HdB: Haxtun	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
JaB, JaC: Jayem	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
JcB, JcC: Jayem	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
KeB, KeC2: Keith	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Ku, KuB, KuC. Kuma				
LaB: Laird	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salts, excess sodium.
Ma, MaB: Mace	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Mc*, McB*:				
Mace	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
Alliance	Fair: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Mm: McCash	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Mo, Mp, MtB: McCook	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
OaF*:				
Otero	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Canyon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
OaG*:				
Otero	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Canyon	Poor: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rs, RsB: Rosebud	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Rt*, RtB*:				
Rosebud	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
Canyon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
RtC*:				
Rosebud	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
Canyon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
RtD2*:				
Rosebud	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, slope.
Canyon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
SaC, SaD Sarben	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
SbB, SbC Satanta	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Sc Scott	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
TaB*:				
Tassel	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
Duda	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too sandy, thin layer.
TaF*:				
Tassel	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
Duda	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too sandy, thin layer.
UsC2, UsD2 Ulysses	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
VaF Valent	Good	Probable	Improbable: too sandy.	Poor: too sandy.
VaG Valent	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
VcB, VcD Valent	Good	Probable	Improbable: too sandy.	Fair: too sandy.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
VeB: Vetal	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Wa: Wann	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
WoB: Woodly	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
WpB: Woodly	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ac: Alliance	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
Af, AfB: Altvan	Severe: seepage.	Severe: seepage.	Deep to water	Favorable	Too sandy	Favorable.
AfC: Altvan	Severe: seepage.	Severe: seepage.	Deep to water	Slope	Too sandy	Favorable.
AsB, AsC: Ascalon	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing.	Soil blowing	Droughty.
BeB: Blanche	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, depth to rock.	Depth to rock, soil blowing.	Depth to rock.
Bg, BgB: Bridget	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Erodes easily	Erodes easily.
BuC: Bushman	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
Cb: Caruso	Moderate: seepage.	Severe: piping, excess sodium.	Flooding, excess salt, excess sodium.	Wetness, flooding.	Wetness	Excess salt, excess sodium.
ChD: Colby	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
ChF, ChG: Colby	Severe: slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
CrB: Creighton	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
CrC: Creighton	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
CrD: Creighton	Severe: slope.	Severe: piping.	Deep to water	Soil blowing, slope, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
DbB: Dailey	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
DuC*:						
Duda	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Depth to rock, too sandy.	Droughty, depth to rock.
Tassel	Severe: depth to rock.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Depth to rock, soil blowing.	Depth to rock.
Fu*. Fluvaquents						
Gb: Gannett	Severe: seepage.	Severe: seepage, piping, ponding.	Ponding, frost action, cutbanks cave.	Ponding, droughty.	Ponding, too sandy.	Wetness, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Gf---------------- Gibbon	Severe: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness---------	Favorable.
Gh---------------- Goshen	Moderate: seepage.	Severe: thin layer.	Deep to water	Favorable-------	Erodes easily	Erodes easily.
HaB--------------- Haxtun	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing---	Favorable.
HdB--------------- Haxtun	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
JaB--------------- Jayem	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Soil blowing---	Favorable.
JaC--------------- Jayem	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing, slope.	Soil blowing---	Favorable.
JcB--------------- Jayem	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
JcC--------------- Jayem	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
KeB--------------- Keith	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
KeC2-------------- Keith	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
Ku, KuB----------- Kuma	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
KuC--------------- Kuma	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
LaB--------------- Laird	Severe: seepage.	Severe: piping, excess sodium, excess salt.	Deep to water	Soil blowing, excess sodium.	Soil blowing---	Excess salt, excess sodium.
Ma, MaB----------- Mace	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
Mc*, McB*:						
Mace--------------	Moderate: seepage, depth to rock.	Severe: thin layer.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
Alliance----------	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
Mm---------------- McCash	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing---	Erodes easily, soil blowing.	Erodes easily.
Mo---------------- McCook	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
Mp, MtB----------- McCook	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-------	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
OaF, OaG*:						
Otero	Severe: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, rooting depth.	Slope, erodes easily, soil blowing.	Slope, erodes easily, rooting depth.
Canyon	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Rs, RsB Rosebud	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
Rt*, RtB*:						
Rosebud	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
Canyon	Severe: depth to rock.	Severe: piping.	Deep to water	Depth to rock	Depth to rock	Depth to rock.
RtC*:						
Rosebud	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
Canyon	Severe: depth to rock.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
RtD2*:						
Rosebud	Severe: slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
Canyon	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
SaC, SaD Sarben	Severe: seepage.	Severe: piping.	Deep to water	Fast intake, soil blowing, slope.	Soil blowing	Favorable.
SbB Satanta	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
SbC Satanta	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
Sc Scott	Moderate: seepage.	Severe: hard to pack, ponding.	Ponding, percs slowly, frost action.	Ponding, percs slowly, erodes easily.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
TaB*:						
Tassel	Severe: depth to rock.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Depth to rock, soil blowing.	Depth to rock.
Duda	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Depth to rock, too sandy.	Droughty, depth to rock.
TaF*:						
Tassel	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
Duda	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, depth to rock, too sandy.	Slope, droughty, depth to rock.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes, and levees	Features affecting-- Drainage	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
UsC2, UsD2: Ulysses	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
VaF, VaG: Valent	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
VcB, VcD: Valent	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
VeB: Vetal	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.
Wa: Wann	Severe: seepage.	Severe: piping, wetness.	Flooding, frost action.	Flooding, wetness, soil blowing.	Wetness, soil blowing.	Favorable.
WoB, WpB: Woodly	Moderate: seepage.	Severe: piping.	Deep to water	Soil blowing	Soil blowing	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ac: Alliance	0-9	Silt loam	ML, CL	A-4, A-6	0	100	100	95-100	70-90	25-40	1-15
	9-17	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	95-100	80-100	30-50	15-25
	17-24	Silt loam, very fine sandy loam.	ML, CL	A-4, A-6	0	100	100	95-100	70-90	25-40	1-15
	24-50	Very fine sandy loam, silt loam, loamy very fine sand.	ML	A-4	5-10	85-90	85-90	60-70	51-65	<30	NP
	50-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Af, AfB, AfC: Altvan	0-7	Loam	ML	A-4	0	100	100	85-100	60-90	25-35	2-10
	7-21	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	70-80	35-50	15-25
	21-26	Loam, silt loam, fine sandy loam.	ML	A-4	0	90-100	85-100	60-95	50-75	25-35	2-10
	26-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP, SP-SM	A-1	0	75-95	70-90	25-35	0-10	---	NP
AsB, AsC: Ascalon	0-10	Fine sandy loam	SM, SM-SC	A-2, A-4	0	95-100	90-100	70-95	25-45	15-25	NP-5
	10-22	Sandy clay loam	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	22-28	Sandy loam, sandy clay loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	35-65	20-40	5-15
	28-60	Fine sandy loam, loamy fine sand, very fine sandy loam.	SM	A-2, A-4	0	95-100	95-100	70-95	20-35	---	NP
BeB: Blanche	0-11	Very fine sandy loam.	SM, ML, CL-ML, SM-SC	A-4	0	100	100	70-95	40-65	<25	NP-6
	11-26	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	100	70-95	40-75	<30	NP-10
	26-34	Fine sandy loam, very fine sandy loam, loamy fine sand.	SM, ML, SC, CL	A-4	0	95-100	95-100	70-95	35-55	<30	NP-10
	34-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Bg, BgB: Bridget	0-12	Silt loam	ML, CL-ML, CL	A-4	0	95-100	95-100	85-95	80-95	20-35	2-10
	12-21	Very fine sandy loam, silt loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-95	80-95	20-35	2-10
	21-60	Very fine sandy loam, loam, silt loam.	ML, CL-ML, CL	A-4	0	95-100	95-100	85-95	80-95	20-35	2-10
BuC: Bushman	0-7	Very fine sandy loam.	SM, ML	A-4	0	80-100	75-100	65-85	35-55	20-25	NP-5
	7-60	Very fine sandy loam, fine sandy loam, sandy loam.	ML, SM	A-4	0	80-100	75-100	70-85	40-55	20-25	NP-5
Cb: Caruso	0-12	Loam	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	65-90	25-40	5-20
	12-60	Loam, clay loam, silt loam.	CL, ML, CL-ML	A-4, A-6, A-7	0	100	100	95-100	65-85	25-45	5-20
ChD, ChF, ChG: Colby	0-4	Silt loam	CL, ML, CL-ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	4-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CrB, CrC, CrD---- Creighton	0-12	Very fine sandy loam.	ML	A-4	0	100	90-100	85-100	50-65	20-25	NP-5
	12-20	Very fine sandy loam, loam.	ML, CL-ML	A-4	0	100	90-100	85-100	60-80	20-30	NP-10
	20-60	Very fine sandy loam, loam.	ML, CL-ML	A-4	0	100	90-100	85-100	60-80	20-30	NP-10
DbB-------------- Dailey	0-14	Loamy sand-------	SM	A-2, A-4	0	100	100	70-95	20-40	---	NP
	14-60	Loamy sand, fine sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	95-100	75-95	5-35	---	NP
DuC*: Duda------------	0-7	Loamy sand-------	SM, SM-SC	A-2	0	100	100	50-75	15-35	<25	NP-5
	7-28	Loamy fine sand, loamy sand, fine sand.	SM, SM-SC	A-2, A-1	0	100	100	45-75	15-35	<25	NP-5
	28-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Tassel----------	0-5	Loamy sand-------	SM	A-2	0	95-100	90-100	65-95	15-30	---	NP
	5-16	Fine sandy loam, loamy very fine sand.	ML, SM	A-4	0	95-100	90-100	75-95	40-65	<35	NP-7
	16-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Fu*. Fluvaquents											
Gb--------------- Gannett	0-4	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	100	90-100	55-100	20-30	3-13
	4-60	Silt loam, very fine sandy loam.	SM, ML, CL, SC	A-4, A-6	0	100	100	90-100	55-100	15-35	NP-15
Gf--------------- Gibbon	0-9	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	90-100	60-100	20-30	2-10
	9-27	Silt loam, very fine sandy loam.	CL, ML, CL-ML	A-4	0	100	100	95-100	55-100	20-30	2-10
	27-60	Stratified fine sandy loam to silt loam.	SM, SC, CL, ML	A-4	0	100	100	70-95	35-90	<25	NP-8
Gh--------------- Goshen	0-10	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	90-100	70-95	20-40	3-20
	10-32	Silty clay loam, loam, silt loam.	CL	A-6, A-4	0	100	100	90-100	65-95	25-40	8-22
	32-60	Silt loam, loam	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	20-35	4-15
HaB-------------- Haxtun	0-13	Loamy fine sand	SM	A-2	0	95-100	80-100	50-75	15-30	---	NP
	13-36	Loam, sandy clay loam, fine sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	80-100	65-85	30-55	15-30	NP-10
	36-60	Clay loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	95-100	80-100	80-100	60-85	20-35	5-15
HdB-------------- Haxtun	0-11	Fine sandy loam	SM, ML	A-2, A-4	0	95-100	80-100	60-95	25-55	15-30	NP
	11-31	Sandy loam, sandy clay loam, loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	80-100	65-85	30-55	15-30	NP-10
	31-50	Clay loam, loam, very fine sandy loam.	CL, CL-ML	A-4, A-6	0	95-100	80-100	80-100	60-85	20-35	5-15
	50-60	Loamy very fine sand, very fine sandy loam.	ML, SM	A-2, A-4	0	95-100	80-100	70-95	35-65	20-35	NP-5

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
JaB, JaC--------- Jayem	0-12	Loamy fine sand	SM	A-2	0	85-100	75-100	75-85	25-35	20-25	NP-5
	12-24	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
	24-60	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
JcB, JcC--------- Jayem	0-11	Fine sandy loam	SM	A-4, A-2	0	85-100	75-100	55-95	25-50	20-25	NP-5
	11-21	Fine sandy loam, very fine sandy loam.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
	21-42	Fine sandy loam, very fine sandy loam, loamy very fine sand.	ML, SM	A-4, A-2	0	85-100	75-100	70-95	25-60	20-25	NP-5
	42-60	Loamy sand, loamy fine sand.	SM	A-2	0	85-100	75-100	65-80	25-35	---	NP
KeB, KeC2-------- Keith	0-6	Silt loam--------	ML, CL, CL-ML	A-4	0	100	100	85-100	85-100	20-35	2-10
	6-23	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
	23-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-35	2-12
Ku, KuB, KuC----- Kuma	0-10	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	95-100	90-100	70-95	25-40	NP-15
	10-35	Silty clay loam, silt loam, loam.	CL	A-6	0	100	95-100	90-100	85-95	30-40	10-20
	35-60	Silt loam, loam	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	85-95	25-40	5-15
LaB-------------- Laird	0-10	Fine sandy loam	SM, SM-SC	A-4	0	100	90-100	70-85	35-50	15-25	NP-10
	10-26	Very fine sandy loam, fine sandy loam, loam.	ML, CL-ML, SM, SM-SC	A-4	0	100	100	70-90	40-65	20-30	NP-10
	26-60	Loamy fine sand, loamy sand, fine sandy loam.	SM	A-2, A-4	0	100	90-100	70-80	25-45	15-20	NP-5
Ma, MaB---------- Mace	0-5	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	25-40	2-15
	5-18	Silty clay loam, clay loam, silt loam.	CL	A-7, A-6	0	100	100	90-100	70-95	30-50	15-25
	18-23	Silt loam, loam, very fine sandy loam.	ML, CL	A-4, A-6	0	100	100	85-100	60-90	25-40	2-15
	23-30	Silt loam, very fine sandy loam, fine sandy loam.	ML	A-4	0	100	100	70-100	50-90	25-40	2-10
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Mc*, McB*: Mace------------	0-6	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	25-40	2-15
	6-18	Silty clay loam, clay loam, silt loam.	CL	A-7, A-6	0	100	100	90-100	70-95	30-50	15-25
	18-24	Silt loam, loam, very fine sandy loam.	ML, CL	A-4, A-6	0	100	100	85-100	60-90	25-40	2-15
	24-34	Silt loam, very fine sandy loam, fine sandy loam.	ML	A-4	0	100	100	70-100	50-90	25-40	2-10
	34-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Mc*, McB*:											
Alliance	0-12	Silt loam	ML, CL	A-4, A-6	0	100	100	95-100	70-90	25-40	1-15
	12-18	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	95-100	80-100	30-50	15-25
	18-21	Silt loam, very fine sandy loam.	ML, CL	A-4, A-6	0	100	100	95-100	70-90	25-40	1-15
	21-45	Very fine sandy loam, silt loam, loamy very fine sand.	ML	A-4	5-10	85-90	85-90	60-70	51-65	<30	NP
	45-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Mm McCash	0-16	Very fine sandy loam.	ML	A-4	0	100	100	90-100	50-80	20-30	NP-7
	16-46	Very fine sandy loam, loamy very fine sand, silt loam.	ML, SM	A-4	0	100	100	90-100	45-80	20-30	NP-7
	46-60	Loamy very fine sand, very fine sandy loam, fine sandy loam.	ML, SM	A-4	0	100	100	90-100	40-65	20-30	NP-7
Mo McCook	0-10	Silt loam	ML, CL, CL-ML	A-4	0	100	100	95-100	60-100	20-35	2-10
	10-60	Very fine sandy loam, silt loam, loam.	ML, CL, CL-ML	A-4	0	100	100	95-100	55-100	<20	NP-10
Mp, MtB McCook	0-15	Silt loam	ML, CL, CL-ML	A-4	0	100	100	95-100	60-100	20-35	2-10
	15-60	Very fine sandy loam, silt loam, loam.	ML, CL, CL-ML	A-4	0	100	100	95-100	80-100	<20	NP-10
OaF*, OaG*:											
Otero	0-7	Loam	ML	A-4	0	100	95-100	85-95	60-80	20-30	NP-5
	7-60	Very fine sandy loam, loamy very fine sand.	ML, SM	A-4	0	100	95-100	85-95	40-60	---	NP
Canyon	0-10	Loam	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	10-17	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	17-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rs, RsB Rosebud	0-5	Loam	ML, CL, CL-ML	A-4, A-6	0	95-100	80-100	80-95	55-90	24-34	3-12
	5-15	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	80-100	60-85	30-50	12-26
	15-34	Loam, sandy clay loam, very fine sandy loam.	SM, ML, SC, CL	A-4, A-6, A-2	0	95-100	80-100	60-85	30-60	20-40	2-12
	34-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rt*, RtB*, RtC*, RtD2*:											
Rosebud	0-6	Loam	ML, CL, CL-ML	A-4, A-6	0	95-100	80-100	80-95	55-90	24-34	3-12
	6-15	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	80-100	60-85	30-50	12-26
	15-30	Loam, sandy clay loam, very fine sandy loam.	SM, ML, SC, CL	A-4, A-6, A-2	0	95-100	80-100	60-85	30-60	20-40	2-12
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Rt*, RtB*, RtC*, RtD2*:											
Canyon	0-11	Loam	ML, CL, CL-ML	A-4	0-5	90-95	75-95	50-95	50-75	15-30	2-10
	11-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	<20	NP-10
	14-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SaC, SaD: Sarben	0-6	Loamy very fine sand.	SM, ML	A-4	0	100	100	90-100	40-60	<25	NP
	6-17	Loamy very fine sand, fine sandy loam, very fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	<20	NP
	17-60	Very fine sandy loam, loamy very fine sand, fine sandy loam.	SM, ML	A-4	0	100	100	90-100	40-65	<20	NP
SbB, SbC: Satanta	0-9	Very fine sandy loam, loam.	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-80	22-36	2-15
	9-23	Loam, clay loam, sandy clay loam.	SC, CL	A-7, A-6	0	100	95-100	75-100	40-75	25-45	11-25
	23-60	Loam, clay loam, fine sandy loam.	ML, CL, SM, SC	A-4, A-6	0	100	95-100	60-100	40-80	20-36	2-15
Sc: Scott	0-4	Silt loam	ML, CL, CL-ML	A-4, A-6, A-7	0	100	100	100	95-100	20-45	2-20
	4-23	Silty clay, clay	CH, CL	A-7	0	100	100	100	95-100	41-75	20-45
	23-32	Silty clay loam	CL, CH	A-7, A-6	0	100	100	100	95-100	35-60	20-40
	32-60	Silt loam, silty clay loam, clay loam.	CL	A-4, A-6, A-7	0	100	100	90-100	90-100	25-50	8-24
TaB*, TaF*:											
Tassel	0-6	Loamy sand	SM	A-2	0	95-100	90-100	65-95	15-30	---	NP
	6-16	Fine sandy loam, loamy very fine sand.	ML, SM	A-4	0	95-100	90-100	75-95	40-65	<35	NP-7
	16-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Duda	0-4	Loamy sand	SM, SM-SC	A-2	0	100	100	50-75	15-35	<25	NP-5
	4-30	Loamy fine sand, loamy sand, sand.	SM, SM-SC	A-2, A-1	0	100	100	45-75	15-35	<25	NP-5
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
UsC2, UsD2: Ulysses	0-5	Silt loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
	5-36	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	85-100	25-43	11-20
	36-60	Silt loam, loam	CL, ML	A-4, A-6	0	100	100	90-100	85-100	25-40	3-15
VaF, VaG: Valent	0-4	Sand	SP-SM, SM	A-2, A-3	0	100	100	70-90	5-25	---	NP
	4-60	Sand	SP, SP-SM	A-3	0	100	95-100	70-90	0-10	---	NP
VcB, VcD: Valent	0-6	Loamy sand	SM, SP-SM	A-2	0	100	100	80-95	10-30	---	NP
	6-60	Sand	SP, SP-SM	A-3	0	100	95-100	70-90	0-10	---	NP
VeB: Vetal	0-9	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	100	85-100	40-55	20-30	NP-7
	9-48	Fine sandy loam, very fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-95	30-65	20-30	NP-7
	48-60	Fine sandy loam, very fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-4, A-2	0	100	100	60-95	30-65	20-30	NP-7

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
Wa----------------- Wann	0-12	Fine sandy loam	SM, SM-SC	A-2, A-4	0	95-100	95-100	70-100	30-50	<25	NP-5
	12-26	Sandy loam, fine sandy loam.	SM, SM-SC	A-2, A-4	0	95-100	95-100	60-100	20-50	<25	NP-5
	26-60	Stratified very fine sandy loam to fine sand.	SM	A-2, A-4	0	95-100	95-100	70-100	15-40	<20	NP-3
WoB---------------- Woodly	0-5	Loamy fine sand	SM, SM-SC	A-2	0	100	100	95-100	15-35	<25	NP-5
	5-24	Sandy clay loam, fine sandy loam, loam.	SC, CL	A-4, A-6	0	100	100	90-100	35-65	30-40	8-15
	24-60	Fine sandy loam, loamy fine sand, very fine sandy loam.	SM, SM-SC	A-4, A-2	0	100	100	85-100	25-50	15-30	NP-7
WpB---------------- Woodly	0-16	Fine sandy loam	SM	A-4	0	100	100	90-100	40-50	20-30	NP-7
	16-38	Sandy clay loam, fine sandy loam, loam.	SC, CL	A-4, A-6	0	100	100	90-100	35-65	30-40	8-15
	38-60	Sandy loam, fine sandy loam, loamy fine sand.	SM, SM-SC	A-4, A-2	0	100	100	85-100	25-50	15-30	NP-7

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	Mmhos/cm					Pct
Ac---------------- Alliance	0-9	18-27	1.20-1.40	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low--------	0.32	5	6	2-4
	9-17	25-35	1.15-1.30	0.2-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.43			
	17-24	16-25	1.20-1.40	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low--------	0.43			
	24-50	10-20	1.30-1.60	0.6-2.0	0.15-0.18	7.4-8.4	<2	Low--------	0.43			
	50-60	---	---	---	---	---	---	-----------	----			
Af, AfB, AfC------ Altvan	0-7	16-23	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.3	<2	Low--------	0.28	4	5	1-2
	7-21	20-35	1.20-1.50	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.28			
	21-26	8-15	1.30-1.50	0.6-2.0	0.17-0.19	7.4-9.0	<2	Low--------	0.28			
	26-60	0-5	1.50-1.70	>20	0.02-0.04	7.4-9.0	<2	Low--------	0.10			
AsB, AsC---------- Ascalon	0-10	5-12	1.25-1.35	0.6-6.0	0.11-0.15	6.6-7.8	<2	Low--------	0.20	5	3	1-3
	10-22	20-30	1.30-1.50	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.20			
	22-28	15-25	1.30-1.50	0.6-6.0	0.11-0.15	7.4-8.4	<2	Low--------	0.20			
	28-60	2-10	1.35-1.60	2.0-6.0	0.06-0.13	7.4-8.4	<2	Low--------	0.20			
BeB--------------- Blanche	0-11	6-16	1.30-1.50	2.0-6.0	0.16-0.18	6.6-7.8	<2	Low--------	0.20	4	3	1-2
	11-26	9-18	1.30-1.50	2.0-6.0	0.15-0.17	6.6-8.4	<2	Low--------	0.20			
	26-34	9-18	1.30-1.60	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low--------	0.20			
	34-60	---	---	---	---	---	---	-----------	----			
Bg, BgB----------- Bridget	0-12	10-18	1.20-1.40	0.6-2.0	0.20-0.24	6.6-7.8	<2	Low--------	0.32	5	5	1-3
	12-21	13-18	1.20-1.40	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.43			
	21-60	13-18	1.20-1.45	0.6-2.0	0.17-0.19	7.4-8.4	<2	Low--------	0.43			
BuC--------------- Bushman	0-7	10-18	1.30-1.50	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low--------	0.32	5	3	1-2
	7-60	10-18	1.25-1.45	2.0-6.0	0.15-0.17	7.4-8.4	<4	Low--------	0.32			
Cb---------------- Caruso	0-12	18-27	1.20-1.35	0.6-2.0	0.19-0.23	7.4-9.0	4-16	Low--------	0.28	5	4L	1-3
	12-60	18-35	1.20-1.35	0.2-2.0	0.16-0.22	7.4-9.0	4-16	Low--------	0.28			
ChD, ChF, ChG----- Colby	0-4	15-30	1.20-1.30	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.43	5	4L	.5-2
	4-60	18-27	1.25-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			
CrB, CrC, CrD----- Creighton	0-12	5-15	1.40-1.55	0.6-2.0	0.15-0.17	6.1-7.8	<2	Low--------	0.32	5	3	1-4
	12-20	5-18	1.40-1.55	0.6-2.0	0.14-0.16	6.6-7.8	<2	Low--------	0.43			
	20-60	5-18	1.35-1.45	0.6-2.0	0.15-0.17	7.9-8.4	<2	Low--------	0.43			
DbB--------------- Dailey	0-14	2-5	1.70-1.85	6.0-20	0.07-0.12	6.6-7.3	<2	Low--------	0.17	5	2	1-3
	14-60	2-5	1.75-1.95	6.0-20	0.04-0.07	6.6-8.4	<2	Low--------	0.17			
DuC*:												
Duda--------------	0-7	3-10	1.15-1.25	2.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	4	2	.5-2
	7-28	3-10	1.45-1.60	2.0-20	0.08-0.10	6.1-7.8	<2	Low--------	0.17			
	28-60	---	---	---	---	---	---	-----------	----			
Tassel------------	0-5	2-8	1.60-1.80	6.0-20	0.10-0.12	7.4-8.4	<2	Low--------	0.17	2	2	.5-1
	5-16	5-12	1.50-1.75	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low--------	0.24			
	16-60	---	---	---	---	---	---	-----------	----			
Fu*. Fluvaquents												
Gb---------------- Gannett	0-4	5-18	1.20-1.50	2.0-6.0	0.15-0.19	7.4-8.4	<2	Low--------	0.28	5	8	4-8
	4-60	5-18	1.20-1.50	2.0-6.0	0.13-0.19	7.4-8.4	<2	Low--------	0.28			
Gf---------------- Gibbon	0-9	12-18	1.40-1.60	0.6-2.0	0.21-0.23	7.4-8.4	<2	Low--------	0.32	5	4L	2-4
	9-27	10-18	1.30-1.50	0.6-2.0	0.18-0.22	7.9-8.4	<2	Moderate	0.32			
	27-60	10-18	1.50-1.70	0.6-6.0	0.16-0.20	7.9-9.0	<2	Low--------	0.32			
Gh---------------- Goshen	0-10	18-27	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	5	1-3
	10-32	25-35	1.30-1.50	0.6-2.0	0.17-0.22	6.6-8.4	<2	Moderate	0.43			
	32-60	15-27	1.20-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low--------	0.43			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea-bility	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH	Mmhos/cm					Pct
HaB----------------	0-13	3-10	1.70-1.85	6.0-20	0.07-0.11	6.6-7.3	<2	Low--------	0.17	5	2	1-3
Haxtun	13-36	15-30	1.30-1.40	0.6-6.0	0.11-0.14	6.6-7.3	<2	Low--------	0.17			
	36-60	18-35	1.35-1.45	0.6-2.0	0.18-0.20	7.4-8.4	<2	Moderate	0.17			
HdB----------------	0-11	6-18	1.30-1.40	2.0-6.0	0.11-0.14	6.6-7.3	<2	Low--------	0.20	5	3	2-4
Haxtun	11-36	15-30	1.30-1.40	0.6-6.0	0.11-0.14	6.6-7.3	<2	Low--------	0.20			
	36-50	18-35	1.35-1.45	0.6-2.0	0.18-0.20	7.4-8.4	<2	Moderate	0.20			
	50-60	3-15	1.35-1.45	0.6-6.0	0.10-0.14	7.4-8.4	<2	Low--------	0.20			
JaB, JaC----------	0-12	3-8	1.30-1.50	2.0-6.0	0.08-0.11	6.6-7.8	<2	Low--------	0.17	5	2	1-3
Jayem	12-24	5-18	1.20-1.40	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low--------	0.24			
	24-60	5-18	1.20-1.40	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low--------	0.24			
JcB, JcC----------	0-11	5-15	1.30-1.40	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low--------	0.20	5	3	1-3
Jayem	11-21	5-18	1.20-1.40	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low--------	0.20			
	21-42	5-18	1.20-1.40	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low--------	0.20			
	42-60	3-10	1.20-1.40	2.0-6.0	0.07-0.09	6.6-7.8	<2	Low--------	0.20			
KeB, KeC2---------	0-6	15-25	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.3	<2	Low--------	0.32	5	6	1-3
Keith	6-23	20-35	1.10-1.20	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.32			
	23-60	10-20	1.30-1.40	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.43			
Ku, KuB, KuC------	0-10	15-27	1.20-1.30	0.6-2.0	0.18-0.21	6.6-7.8	<2	Low--------	0.32	5	5	2-4
Kuma	10-35	18-35	1.10-1.20	0.6-2.0	0.18-0.21	6.6-8.4	<2	Low--------	0.37			
	35-60	15-27	1.30-1.40	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low--------	0.32			
LaB----------------	0-10	6-16	1.40-1.50	2.0-6.0	0.10-0.15	7.9-9.0	4-16	Low--------	0.20	5	3	1-2
Laird	10-26	10-18	1.40-1.50	2.0-6.0	0.10-0.13	>7.8	>16	Low--------	0.20			
	26-60	5-14	1.40-1.50	2.0-20.0	0.08-0.10	7.4-9.0	>16	Low--------	0.20			
Ma, MaB-----------	0-5	11-25	1.30-1.50	0.6-2.0	0.20-0.24	6.6-7.3	<2	Low--------	0.32	4	6	1-3
Mace	5-18	25-35	1.30-1.70	0.2-0.6	0.16-0.22	6.6-7.8	<2	Moderate	0.32			
	18-23	18-27	1.30-1.50	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.32			
	23-30	10-25	1.30-1.40	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low--------	0.32			
	30-60	---	---	---	---	---	---	-----------	----			
Mc*, McB*:												
Mace-------------	0-6	11-25	1.30-1.50	0.6-2.0	0.20-0.24	6.6-7.3	<2	Low--------	0.32	4	6	1-3
	6-18	25-35	1.30-1.70	0.2-0.6	0.16-0.22	6.6-7.8	<2	Moderate	0.32			
	18-24	18-27	1.30-1.50	0.6-2.0	0.18-0.22	7.4-8.4	<2	Low--------	0.32			
	24-34	10-25	1.30-1.40	0.6-2.0	0.15-0.20	7.4-8.4	<2	Low--------	0.32			
	34-60	---	---	---	---	---	---	-----------	----			
Alliance---------	0-12	18-27	1.20-1.40	0.6-2.0	0.22-0.24	6.6-7.8	<2	Low--------	0.32	5	6	2-4
	12-18	25-35	1.15-1.30	0.2-2.0	0.18-0.20	6.6-7.8	<2	Moderate	0.43			
	18-21	16-25	1.20-1.40	0.6-2.0	0.20-0.22	6.6-8.4	<2	Low--------	0.43			
	21-45	10-20	1.30-1.60	0.6-2.0	0.15-0.18	7.4-8.4	<2	Low--------	0.43			
	45-60	---	---	---	---	---	---	-----------	----			
Mm-----------------	0-16	8-18	1.20-1.40	0.6-2.0	0.20-0.24	6.1-7.8	<2	Low--------	0.32	5	3	1-2
McCash	16-46	8-18	1.20-1.40	0.6-2.0	0.13-0.22	6.1-7.8	<2	Low--------	0.43			
	46-60	5-12	1.20-1.50	0.6-2.0	0.12-0.19	6.6-7.8	<2	Low--------	0.24			
Mo-----------------	0-10	15-20	1.20-1.40	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.32	5	4L	2-4
McCook	10-60	10-18	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low--------	0.43			
Mp, MtB-----------	0-15	15-20	1.20-1.40	0.6-2.0	0.20-0.24	7.4-8.4	<2	Low--------	0.32	5	4L	2-4
McCook	15-60	10-18	1.30-1.45	0.6-2.0	0.17-0.20	7.4-8.4	<2	Low--------	0.43			
OaF*, OaG*:												
Otero------------	0-7	5-18	1.40-1.60	2.0-6.0	0.18-0.22	7.4-8.4	<2	Low--------	0.32	5	4L	.5-1
	7-60	5-10	1.45-1.75	2.0-6.0	0.12-0.19	7.4-8.4	<2	Low--------	0.32			
Canyon-----------	0-10	10-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.32	2	4L	.5-1
	10-17	10-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	0.43			
	17-60	---	---	---	---	---	---	-----------	----			

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH	Mmhos/cm					Pct
Rs, RsB----------- Rosebud	0-5	8-25	1.20-1.40	0.6-2.0	0.22-0.24	6.6-8.4	<2	Low--------	0.28	4	6	2-4
	5-15	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.28			
	15-34	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-8.4	<2	Low--------	0.28			
	34-60	---	---	---	---	---	---	-----------	----			
Rt*, RtB*, RtC*, RtD2*:												
Rosebud---------	0-6	8-25	1.20-1.40	0.6-2.0	0.22-0.24	6.6-8.4	<2	Low--------	0.28	4	6	2-4
	6-15	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.28			
	15-30	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-8.4	<2	Low--------	0.28			
	30-60	---	---	---	---	---	---	-----------	----			
Canyon----------	0-11	10-20	1.20-1.30	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low--------	0.32	2	4L	.5-1
	11-14	10-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	0.43			
	14-60	---	---	---	---	---	---	-----------	----			
SaC, SaD---------- Sarben	0-6	10-18	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low--------	0.24	5	2	.5-2
	6-17	10-18	1.20-1.40	2.0-6.0	0.16-0.18	6.6-7.3	<2	Low--------	0.24			
	17-60	10-18	1.20-1.40	2.0-6.0	0.15-0.17	6.6-8.4	<2	Low--------	0.24			
SbB, SbC---------- Satanta	0-9	10-25	1.30-1.40	0.6-2.0	0.20-0.22	6.1-7.8	<2	Low--------	0.28	5	6	1-2
	9-23	18-35	1.35-1.45	0.6-2.0	0.15-0.19	6.6-8.4	<2	Moderate	0.28			
	23-60	10-28	1.35-1.50	0.6-2.0	0.16-0.19	7.4-8.4	<2	Low--------	0.28			
Sc---------------- Scott	0-4	15-35	1.25-1.40	0.6-2.0	0.21-0.24	5.6-7.3	<2	Low--------	0.37	3	6	2-4
	4-23	40-55	1.20-1.40	<0.06	0.10-0.14	5.6-7.8	<2	High-------	0.37			
	23-32	27-40	1.15-1.40	0.2-0.6	0.18-0.20	6.6-7.8	<2	High-------	0.37			
	32-60	18-35	1.30-1.50	0.6-2.0	0.14-0.22	6.6-7.8	<2	Moderate	0.37			
TaB*, TaF*:												
Tassel-----------	0-6	2-8	1.60-1.80	6.0-20	0.10-0.12	7.4-8.4	<2	Low--------	0.17	2	2	.5-1
	6-16	5-12	1.50-1.75	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low--------	0.24			
	16-60	---	---	---	---	---	---	-----------	----			
Duda-------------	0-4	3-10	1.15-1.25	2.0-20	0.10-0.12	6.1-7.3	<2	Low--------	0.17	4	2	.5-2
	4-30	3-10	1.45-1.60	2.0-20	0.08-0.10	6.1-7.8	<2	Low--------	0.17			
	30-60	---	---	---	---	---	---	-----------	----			
UsC2, UsD2-------- Ulysses	0-5	10-27	1.15-1.25	0.6-2.0	0.20-0.24	6.6-7.8	<2	Low--------	0.32	5	6	1-3
	5-36	21-32	1.20-1.35	0.6-2.0	0.18-0.22	7.4-8.4	<2	Moderate	0.43			
	36-60	18-27	1.25-1.35	0.6-2.0	0.18-0.22	7.9-8.4	<2	Low--------	0.43			
VaF, VaG---------- Valent	0-4	2-6	1.50-1.60	6.0-20	0.05-0.10	6.6-7.8	<2	Low--------	0.15	5	1	.5-1
	4-60	2-6	1.50-1.60	>20	0.03-0.05	6.6-7.8	<2	Low--------	0.15			
VcB, VcD---------- Valent	0-6	3-10	1.50-1.60	6.0-20	0.07-0.12	6.6-7.8	<2	Low--------	0.15	5	1	.5-1
	6-60	2-6	1.50-1.60	>20	0.03-0.05	6.6-7.8	<2	Low--------	0.15			
VeB--------------- Vetal	0-9	10-18	1.25-1.35	2.0-6.0	0.14-0.17	6.6-7.8	<2	Low--------	0.20	5	3	1-3
	9-48	12-18	1.25-1.40	2.0-6.0	0.11-0.19	6.6-7.8	<2	Low--------	0.20			
	48-60	10-18	1.30-1.40	2.0-6.0	0.10-0.17	6.6-8.4	<2	Low--------	0.20			
Wa---------------- Wann	0-12	5-15	1.70-1.90	2.0-6.0	0.13-0.18	6.6-8.4	<2	Low--------	0.20	5	3	1-3
	12-26	3-15	1.70-1.90	2.0-6.0	0.11-0.17	7.4-8.4	<2	Low--------	0.20			
	26-60	3-10	1.40-1.60	2.0-6.0	0.09-0.12	7.4-8.4	<2	Low--------	0.15			
WoB--------------- Woodly	0-5	2-10	1.30-1.45	2.0-6.0	0.10-0.12	6.1-7.3	<2	Low--------	0.17	5	2	1-3
	5-24	18-27	1.30-1.40	0.6-2.0	0.17-0.19	6.1-7.8	<2	Moderate	0.20			
	24-60	10-20	1.35-1.45	2.0-6.0	0.09-0.15	6.6-8.4	<2	Low--------	0.20			
WpB--------------- Woodly	0-16	10-20	1.30-1.40	2.0-6.0	0.14-0.17	6.1-7.3	<2	Low--------	0.20	5	3	2-4
	16-38	18-27	1.30-1.40	0.6-2.0	0.17-0.19	6.1-7.8	<2	Moderate	0.20			
	38-60	10-20	1.35-1.45	2.0-6.0	0.09-0.15	6.6-8.4	<2	Low--------	0.20			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," and "apparent" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Ac----------------- Alliance	B	None---------	---	---	>6.0	---	---	40-60	Soft	Moderate	High------	Low.
Af, AfB, AfC------- Altvan	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Low-------	Low.
AsB, AsC----------- Ascalon	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
BeB---------------- Blanche	B	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	Low-------	Low.
Bg, BgB------------ Bridget	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Low.
BuC---------------- Bushman	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	Moderate	Low.
Cb----------------- Caruso	C	Occasional	Very brief	Apr-Sep	2.0-3.0	Apparent	Mar-Jun	>60	---	Moderate	High------	Moderate.
ChD, ChF, ChG------ Colby	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	Low-------	Low.
CrB, CrC, CrD------ Creighton	B	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
DbB---------------- Dailey	A	None---------	---	---	>6.0	---	---	>60	---	Low-------	High------	Low.
DuC*:												
Duda---------------	A	None---------	---	---	>6.0	---	---	20-40	Soft	Low-------	Moderate	Low.
Tassel-------------	D	None---------	---	---	>6.0	---	---	6-20	Soft	Low-------	High------	Low.
Fu*. Fluvaquents												
Gb**--------------- Gannett	D	None---------	---	---	+.5-1.0	Apparent	Nov-May	>60	---	High------	High------	Low.
Gf----------------- Gibbon	B	Occasional	Very brief	Mar-Jul	1.5-3.0	Apparent	Nov-Jun	>60	---	High------	High------	Low.
Gh----------------- Goshen	B	Rare---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Low.
HaB, HdB----------- Haxtun	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	High------	Low.

See footnotes at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
JaB, JaC, JcB, JcC: Jayem	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
KeB, KeC2: Keith	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Ku, KuB, KuC: Kuma	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Low.
LaB: Laird	B	None	---	---	>6.0	---	---	>60	---	Moderate	High	Moderate.
Ma, MaB: Mace	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
Mc*, McB*:												
Mace	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
Alliance	B	None	---	---	>6.0	---	---	40-60	Soft	Moderate	High	Low.
Mm: McCash	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Mo: McCook	B	Rare	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.
Mp: McCook	B	Occasional	Very brief	Apr-Jul	>6.0	---	---	>60	---	Moderate	Low	Low.
MtB: McCook	B	Frequent	Very brief	Apr-Jul	>6.0	---	---	>60	---	Moderate	Low	Low.
OaF*, OaG*:												
Otero	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
Canyon	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
Rs, RsB: Rosebud	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
Rt*, RtB*, RtC*, RtD2*:												
Rosebud	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	High	Low.
Canyon	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
SaC, SaD: Sarben	B	None	---	---	>6.0	---	---	>60	---	Low	High	Low.
SbB, SbC: Satanta	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low	Low.

See footnotes at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
Sc**: Scott	D	None	---	---	+.5-1.0	Perched	Mar-Aug	>60	---	High	High	Low.
TaB*, TaF*:												
Tassel	D	None	---	---	>6.0	---	---	6-20	Soft	Low	High	Low.
Duda	A	None	---	---	>6.0	---	---	20-40	Soft	Low	Moderate	Low.
UsC2, UsD2: Ulysses	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
VaF, VaG, VcB, VcD: Valent	A	None	---	---	>6.0	---	---	>60	---	Low	Low	Low.
VeB: Vetal	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.
Wa: Wann	B	Occasional	Brief	Mar-Nov	1.5-3.5	Apparent	Mar-Jul	>60	---	High	Moderate	Low.
WoB, WpB: Woodly	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

** In the "High water table--Depth" column, a plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

TABLE 18.--ENGINEERING TEST DATA

[Dashes indicate data were not available. NP means nonplastic]

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution									Liquid limit	Plasticity index	Particle density
			Percentage passing sieve--						Percentage smaller than--					
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			
												Pct		G/cc
Ascalon fine sandy loam: (S76NE-029-049)														
Ap--------0 to 6	A-4 (02)	SM	100	100	100	100	92	44	34	9	7	19	NP	2.61
B22t-----14 to 20	A-6 (06)	CL	100	100	100	100	95	55	46	23	21	32	15	2.67
C1ca-----26 to 40	A-4 (00)	SM	100	100	100	100	94	36	25	11	9	19	NP	2.67
Blanche very fine sandy loam: (S78NE-029-031)														
Ap--------0 to 6	A-4 (03)	SM	100	100	100	100	94	49	32	9	6	21	1	2.61
A12-------6 to 11	A-4 (03)	CL-ML	100	100	100	100	95	52	40	12	8	24	6	2.61
B21------11 to 19	A-4 (03)	SM-SC	100	100	100	100	94	49	36	14	9	24	7	2.65
B22------19 to 26	A-4 (03)	SM-SC	100	100	100	100	94	49	35	12	9	22	5	2.64
B3ca-----26 to 34	A-4 (02)	SC	100	100	99	98	90	44	37	18	14	26	10	2.67
Dailey loamy sand: (S76NE-029-012)														
A1--------0 to 14	A-2-4(01)	SM	100	100	100	100	87	21	15	6	4	--	NP	2.63
C--------14 to 60	A-3 (02)	SP-SM	100	100	100	100	78	7	6	4	4	--	NP	2.62
Goshen silt loam: (S76NE-029-045)														
B21t-----10 to 18	A-6 (12)	CL	100	100	100	100	98	88	78	33	28	39	19	2.64
C1ca-----36 to 48	A-4 (08)	CL	100	100	100	100	99	91	78	24	18	31	8	2.68
Haxtun fine sandy loam: (S76NE-029-017)														
Ap--------0 to 5	A-4 (03)	ML	100	100	100	100	91	51	25	8	7	29	NP	2.62
B22tb----18 to 31	A-6 (10)	CL	100	100	100	100	99	84	71	30	21	34	14	2.60
C--------50 to 60	A-4 (08)	ML	100	100	100	100	100	83	56	12	7	--	NP	2.65
Jayem fine sandy loam: (S76NE-029-021)														
A1--------0 to 11	A-2-4(00)	SM	100	100	100	100	93	25	18	8	7	--	NP	2.63
B2-------11 to 21	A-2-4(00)	SM	100	100	100	100	94	25	18	10	8	--	NP	2.65
C1-------21 to 42	A-2-4(00)	SM	100	100	100	100	94	22	15	9	7	--	NP	2.64
Kuma silt loam: (S76NE-029-048)														
Ap--------0 to 5	A-4 (08)	ML	100	100	100	100	100	91	75	19	16	28	4	2.59
B22tb----18 to 29	A-6 (10)	CL	100	100	100	100	100	92	81	28	25	35	14	2.65
C1ca-----42 to 48	A-4 (08)	CL	100	100	100	100	100	90	74	26	17	31	10	2.67

TABLE 18.--ENGINEERING TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution									Liquid limit	Plasticity index	Particle density
			Percentage passing sieve--						Percentage smaller than--					
	AASHTO	Unified	3/4 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm			
												Pct		G/cc
Mace silt loam: (S76NE-029-043)														
Ap--------0 to 5	A-4 (08)	CL-ML	100	100	100	100	97	85	74	19	11	29	7	2.59
B22tb----11 to 18	A-7-6(17)	CL	100	100	100	100	99	93	86	39	31	47	22	2.64
Rosebud loam: (S76NE-029-037)														
Ap--------0 to 5	A-4 (08)	CL-ML	100	100	100	100	95	75	62	15	8	26	5	2.60
B2t-------5 to 15	A-7-6(16)	CL	100	100	100	100	96	83	74	38	34	49	26	2.69
Valent sand: (S76NE-029-047)														
A1--------0 to 4	A-2-4(01)	SM	100	100	100	100	89	21	12	5	4	--	NP	2.61
C---------4 to 60	A-2-4(02)	SM	100	100	100	100	89	13	7	4	4	--	NP	2.66
Vetal fine sandy loam: (S76NE-029-019)														
AC-------22 to 48	A-4 (02)	SM	100	100	100	100	97	43	33	13	11	--	NP	2.65
C--------48 to 60	A-2-4(00)	SM	100	100	100	100	94	24	13	7	6	--	NP	2.65

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Alliance	Fine-silty, mixed, mesic Aridic Argiustolls
Altvan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Ascalon	Fine-loamy, mixed, mesic Aridic Argiustolls
Blanche	Coarse-loamy, mixed, mesic Aridic Haplustolls
Bridget	Coarse-silty, mixed, mesic Torriorthentic Haplustolls
Bushman	Coarse-loamy, mixed, mesic Torriorthentic Haplustolls
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Caruso	Fine-loamy, mixed, mesic Fluvaquentic Haplustolls
Colby	Fine-silty, mixed (calcareous), mesic Ustic Torriorthents
Creighton	Coarse-loamy, mixed, mesic Aridic Haplustolls
Dailey	Sandy, mixed, mesic Torriorthentic Haplustolls
*Duda	Mixed, mesic Typic Ustipsamments
Fluvaquents	Mixed, mesic Fluvaquents
*Gannett	Coarse-loamy, mixed, mesic Typic Haplaquolls
*Gibbon	Fine-silty, mixed (calcareous), mesic Fluvaquentic Haplaquolls
Goshen	Fine-silty, mixed, mesic Pachic Argiustolls
Haxtun	Fine-loamy, mixed, mesic Pachic Argiustolls
Jayem	Coarse-loamy, mixed, mesic Aridic Haplustolls
Keith	Fine-silty, mixed, mesic Aridic Argiustolls
Kuma	Fine-silty, mixed, mesic Pachic Argiustolls
Laird	Coarse-loamy, mixed, mesic Aridic Calciustolls
Mace	Fine-silty, mixed, mesic Aridic Argiustolls
McCash	Coarse-silty, mixed, mesic Pachic Haplustolls
McCook	Coarse-silty, mixed, mesic Fluventic Haplustolls
Otero	Coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents
Rosebud	Fine-loamy, mixed, mesic Aridic Argiustolls
Sarben	Coarse-loamy, mixed, nonacid, mesic Ustic Torriorthents
Satanta	Fine-loamy, mixed, mesic Aridic Argiustolls
Scott	Fine, montmorillonitic, mesic Typic Argialbolls
Tassel	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Ulysses	Fine-silty, mixed, mesic Aridic Haplustolls
Valent	Mixed, mesic Ustic Torripsamments
Vetal	Coarse-loamy, mixed, mesic Pachic Haplustolls
Wann	Coarse-loamy, mixed, mesic Fluvaquentic Haplustolls
Woodly	Fine-loamy, mixed, mesic Pachic Argiustolls

* The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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NRCS Accessibility Statement

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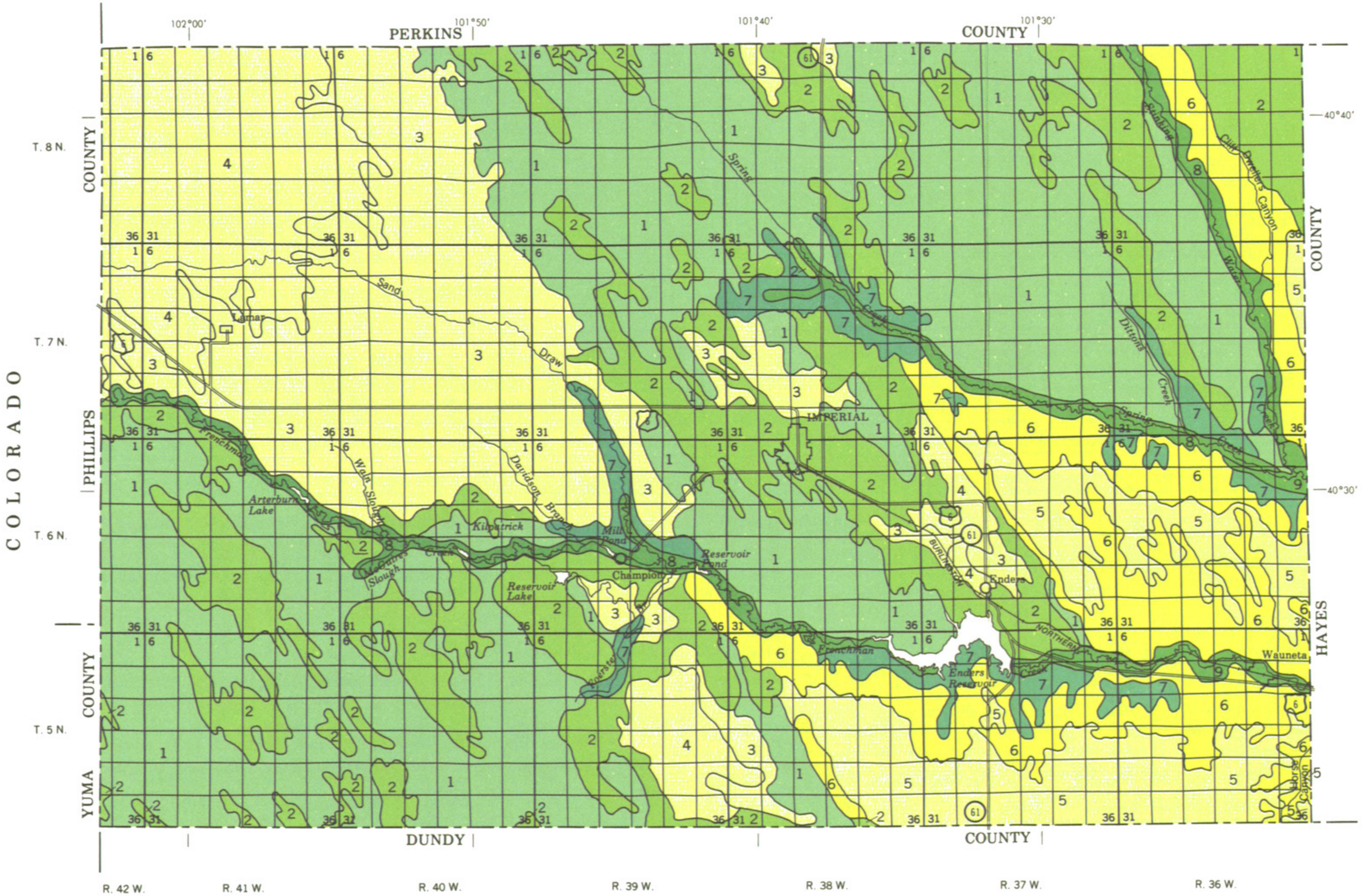
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
UNIVERSITY OF NEBRASKA CONSERVATION AND SURVEY DIVISION

GENERAL SOIL MAP

CHASE COUNTY, NEBRASKA

Scale 1: 253,440



SOIL LEGEND*

DEEP, SANDY SOILS ON UPLANDS

1 Valent association: Deep, nearly level to very steep, excessively drained, sandy soils that formed in eolian sands

DEEP, LOAMY AND SANDY SOILS ON UPLANDS

2 Woodly-Jayem-Ascalon association: Deep, nearly level to gently sloping, well drained, loamy and sandy soils that formed in loamy and sandy eolian material

DEEP TO SHALLOW, SILTY AND LOAMY SOILS ON UPLANDS

3 Rosebud-Canyon association: Moderately deep and shallow, nearly level to strongly sloping, well drained, loamy soils that formed in residuum of weakly cemented caliche

4 Alliance-Mace-Kuma association: Deep and moderately deep, nearly level and very gently sloping, well drained, silty soils that formed in loess and residuum of weakly cemented caliche

5 Kuma association: Deep, nearly level to gently sloping, well drained, silty soils that formed in loess

DEEP, SILTY SOILS ON UPLANDS

6 Colby association: Deep, strongly sloping to very steep, well drained and somewhat excessively drained, silty soils that formed in loess

DEEP AND SHALLOW, LOAMY SOILS ON UPLANDS

7 Otero-Canyon association: Deep and shallow, strongly sloping to very steep, well drained, loamy soils that formed in loamy material and residuum of weakly cemented caliche

DEEP, SILTY AND LOAMY SOILS ON BOTTOM LANDS AND STREAM TERRACES

8 Gannett-Wann-Gibbon association: Deep, nearly level, very poorly drained and somewhat poorly drained, silty and loamy soils that formed in alluvium

9 Bridget-McCook association: Deep, nearly level to very gently sloping, well drained and moderately well drained, silty soils that formed in colluvial and alluvial deposits

*The texture given in the descriptive heading of each association refers to the surface layer of the major soils in that association.

Compiled 1981

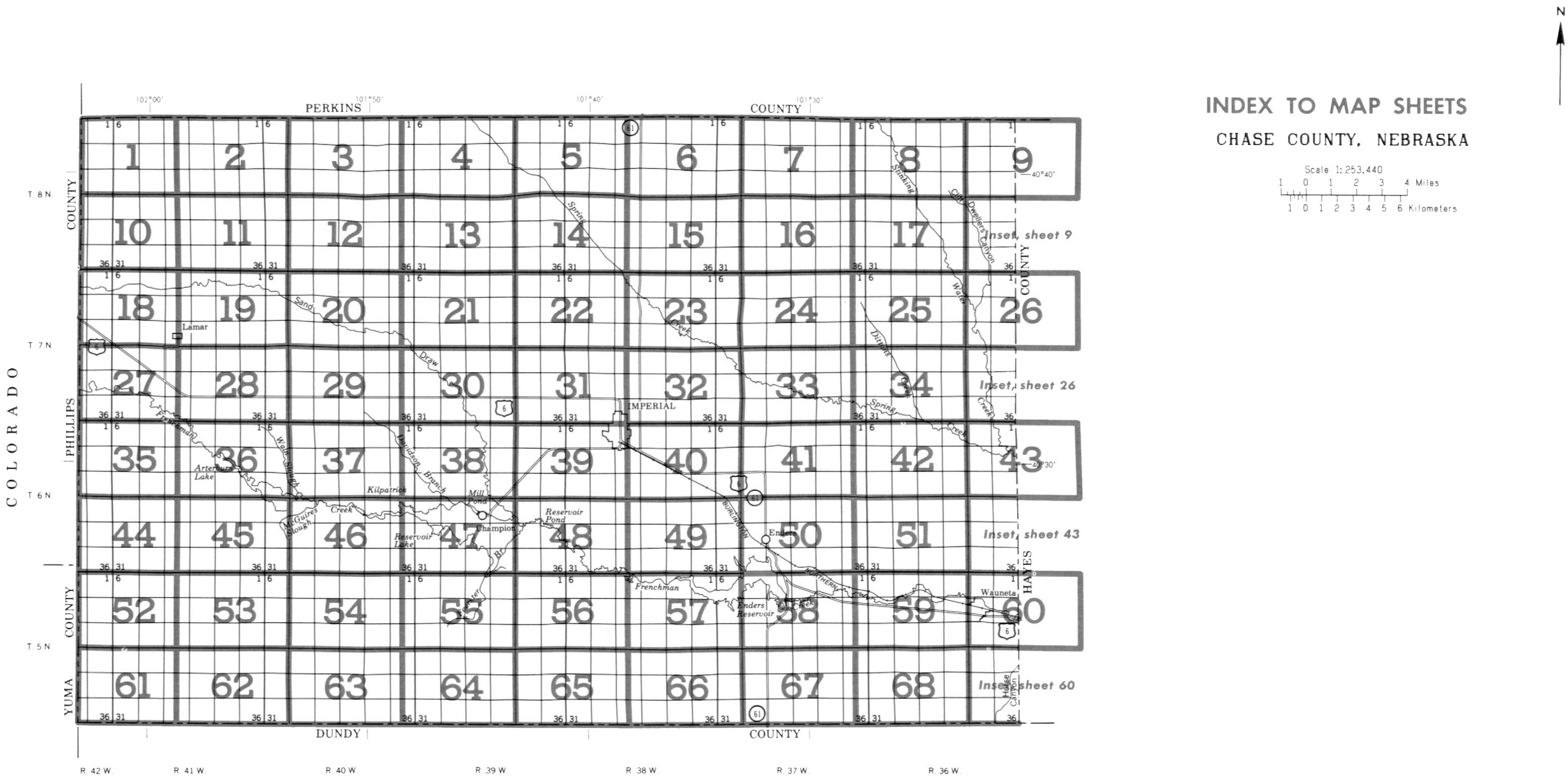
Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

CHASE COUNTY, NEBRASKA



Original text from each individual map sheet read:
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

Map symbols consist of a combination of letters or of letters and a number. The first capital letter is the initial one of the map unit name. The lowercase letter that follows separates map units having names that begin with the same letter, except that it does not separate sloping or eroded phases. The second capital letter indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 indicates that the soil is eroded.

SYMBOL	NAME
Ac	Alliance silt loam, 0 to 1 percent slopes
Af	Altvan loam, 0 to 1 percent slopes
AfB	Altvan loam, 1 to 3 percent slopes
AfC	Altvan loam, 3 to 6 percent slopes
AsB	Ascalon fine sandy loam, 1 to 3 percent slopes
AsC	Ascalon fine sandy loam, 3 to 6 percent slopes
BeB	Blanche very fine sandy loam, 0 to 3 percent slopes
Bg	Bridget silt loam, 0 to 1 percent slopes
BgB	Bridget silt loam, 1 to 3 percent slopes
BuC	Bushman very fine sandy loam, 1 to 4 percent slopes
Cb	Caruso loam, 0 to 2 percent slopes
ChD	Colby silt loam, 6 to 9 percent slopes
ChF	Colby silt loam, 9 to 30 percent slopes
ChG	Colby silt loam, 30 to 60 percent slopes
CrB	Creighton very fine sandy loam, 1 to 3 percent slopes
CrC	Creighton very fine sandy loam, 3 to 6 percent slopes
CrD	Creighton very fine sandy loam, 6 to 11 percent slopes
DbB	Dailey loamy sand, 0 to 3 percent slopes
DuC	Duda-Tassel loamy sands, 3 to 6 percent slopes
Fu	Fluvaquents, silty
Gb	Gannett silt loam, overwash, 0 to 2 percent slopes
Gf	Gibbon silt loam, 0 to 2 percent slopes
Gh	Goshen silt loam, 0 to 1 percent slopes
HaB	Haxtun loamy fine sand, 0 to 3 percent slopes
HdB	Haxtun fine sandy loam, 0 to 3 percent slopes
JaB	Jayem loamy fine sand, 0 to 3 percent slopes
JaC	Jayem loamy fine sand, 3 to 6 percent slopes
JcB	Jayem fine sandy loam, 0 to 3 percent slopes
JcC	Jayem fine sandy loam, 3 to 6 percent slopes
KeB	Keith silt loam, 1 to 3 percent slopes
KeC2	Keith silt loam, 3 to 6 percent slopes, eroded
Ku	Kuma silt loam, 0 to 1 percent slopes
KuB	Kuma silt loam, 1 to 3 percent slopes
KuC	Kuma silt loam, 3 to 6 percent slopes
LaB	Laird fine sandy loam, 0 to 3 percent slopes
Ma	Mace silt loam, 0 to 1 percent slopes
MaB	Mace silt loam, 1 to 3 percent slopes
Mc	Mace-Alliance silt loams, 0 to 1 percent slopes
McB	Mace-Alliance silt loams, 1 to 3 percent slopes
Mm	McCash very fine sandy loam, 0 to 1 percent slopes
Mo	McCook silt loam, 0 to 2 percent slopes
Mp	McCook silt loam, occasionally flooded, 0 to 2 percent slopes
MtB	McCook silt loam, channeled, 0 to 3 percent slopes
OaF	Otero-Canyon loams, 6 to 20 percent slopes
OaG	Otero-Canyon loams, 20 to 45 percent slopes
Rs	Rosebud loam, 0 to 1 percent slopes
RsB	Rosebud loam, 1 to 3 percent slopes
Rt	Rosebud-Canyon loams, leveled, 0 to 1 percent slopes
RtB	Rosebud-Canyon loams, 0 to 3 percent slopes
RtC	Rosebud-Canyon loams, 3 to 6 percent slopes
RtD2	Rosebud-Canyon loams, 6 to 11 percent slopes, eroded
SaC	Sarben loamy very fine sand, 3 to 6 percent slopes
SaD	Sarben loamy very fine sand, 6 to 9 percent slopes
SbB	Satanta very fine sandy loam, 1 to 3 percent slopes
SbC	Satanta very fine sandy loam, 3 to 6 percent slopes
Sc	Scott silt loam, 0 to 1 percent slopes
TaB	Tassel-Duda loamy sands, 0 to 3 percent slopes
TaF	Tassel-Duda loamy sands, 3 to 30 percent slopes
UsC2	Ulysses silt loam, 3 to 6 percent slopes, eroded
UsD2	Ulysses silt loam, 6 to 9 percent slopes, eroded
VaF	Valent sand, rolling
VaG	Valent sand, rolling and hilly
VcB	Valent loamy sand, 0 to 3 percent slopes
VcD	Valent loamy sand, 3 to 9 percent slopes
VeB	Vetal fine sandy loam, 0 to 3 percent slopes
Wa	Wann fine sandy loam, 0 to 2 percent slopes
WoB	Woodly loamy fine sand, 0 to 3 percent slopes
WpB	Woodly fine sandy loam, 0 to 3 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County
- Reservation (national forest or park, state forest or park, and large airport)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery — Davis Airstrip

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

DAMS

- Large (to scale)
- Medium or small — water, w

PITS

- Gravel pit

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Located object (label) — Tower

WATER FEATURES

DRAINAGE

- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water, w
- Intermittent — int, i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — VcB, VeB

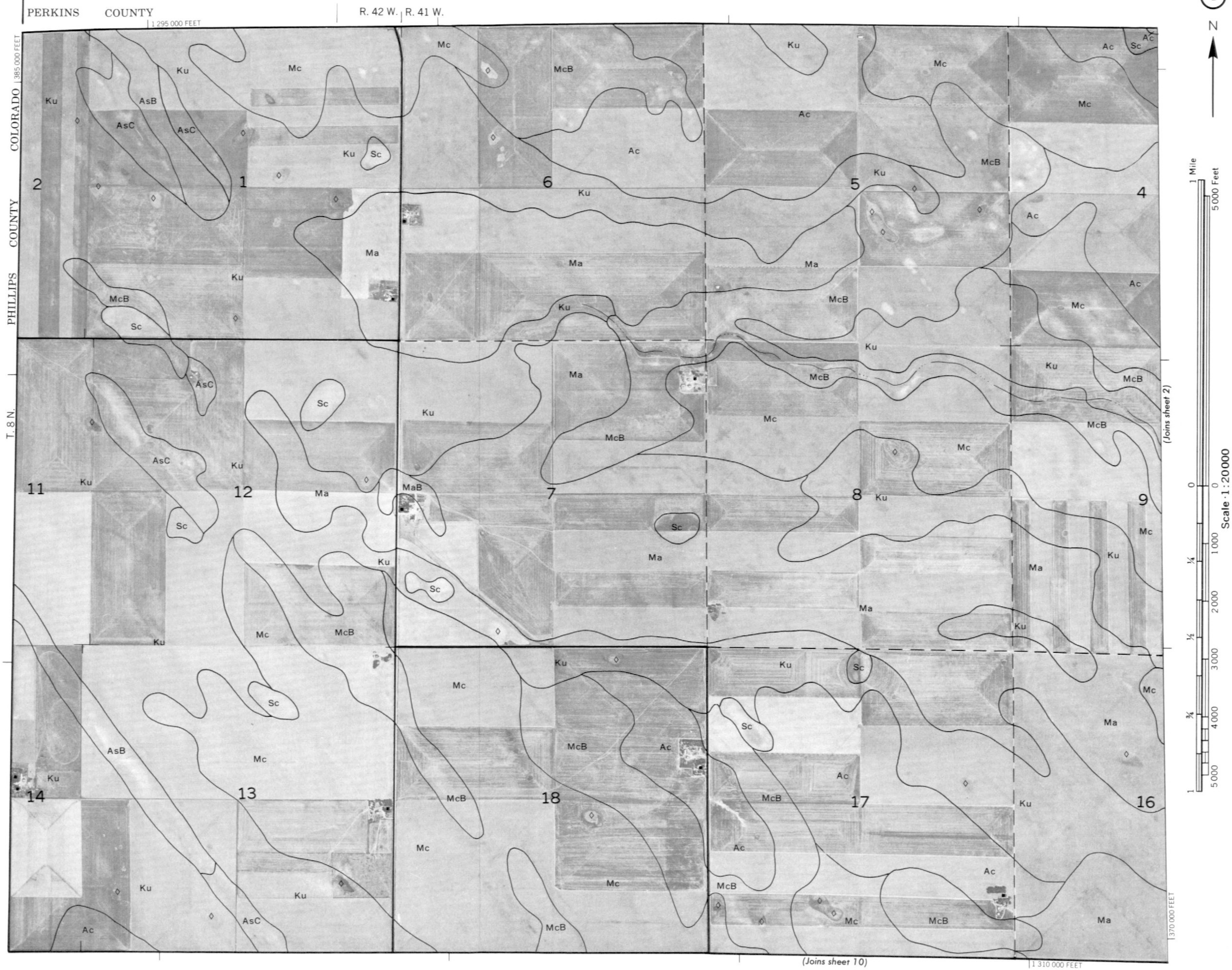
SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

MISCELLANEOUS

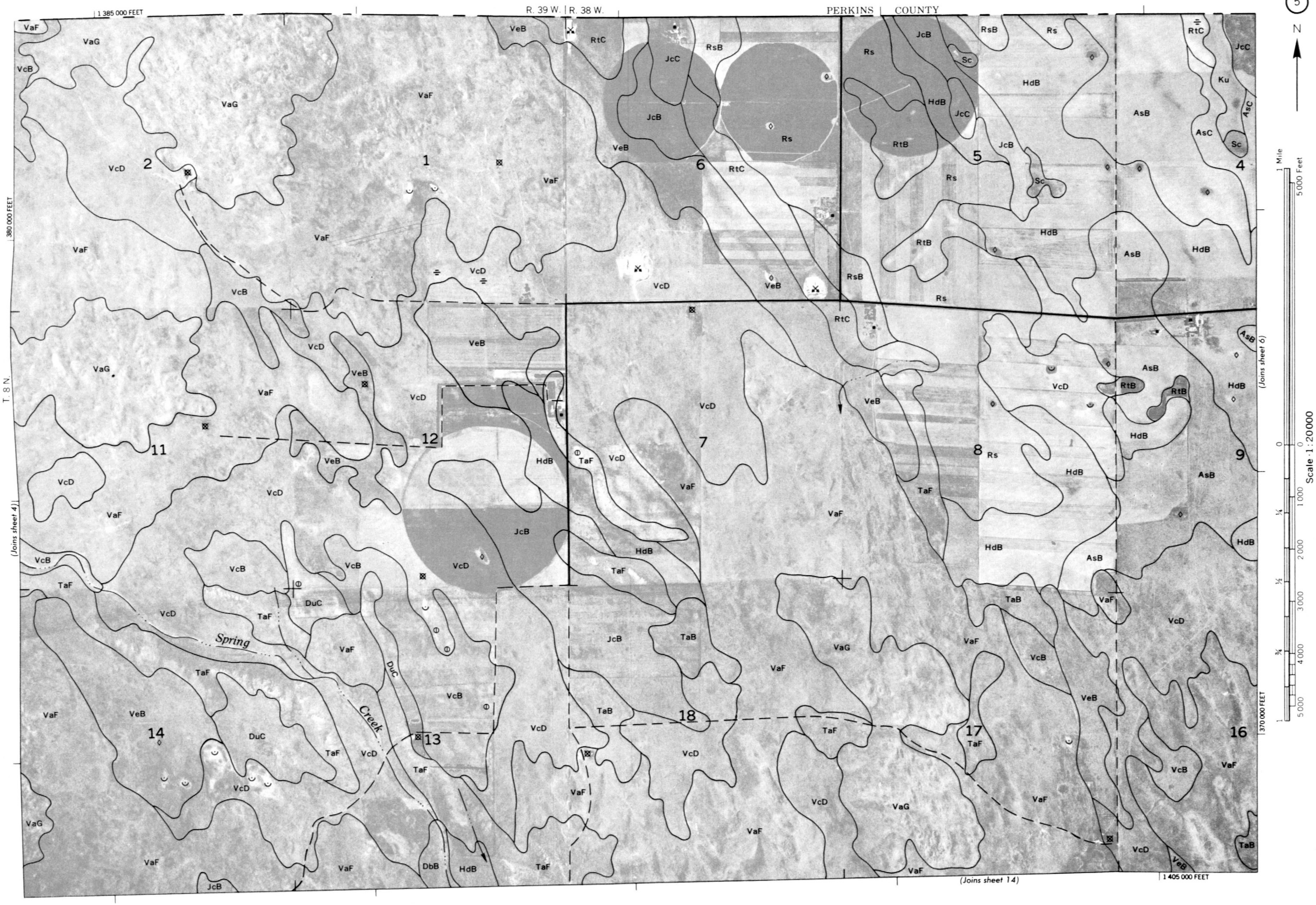
- Blowout
- Gravelly spot
- Sandy spot
- Severely eroded spot
- Livestock Water Facility
- Calcareous silty spot

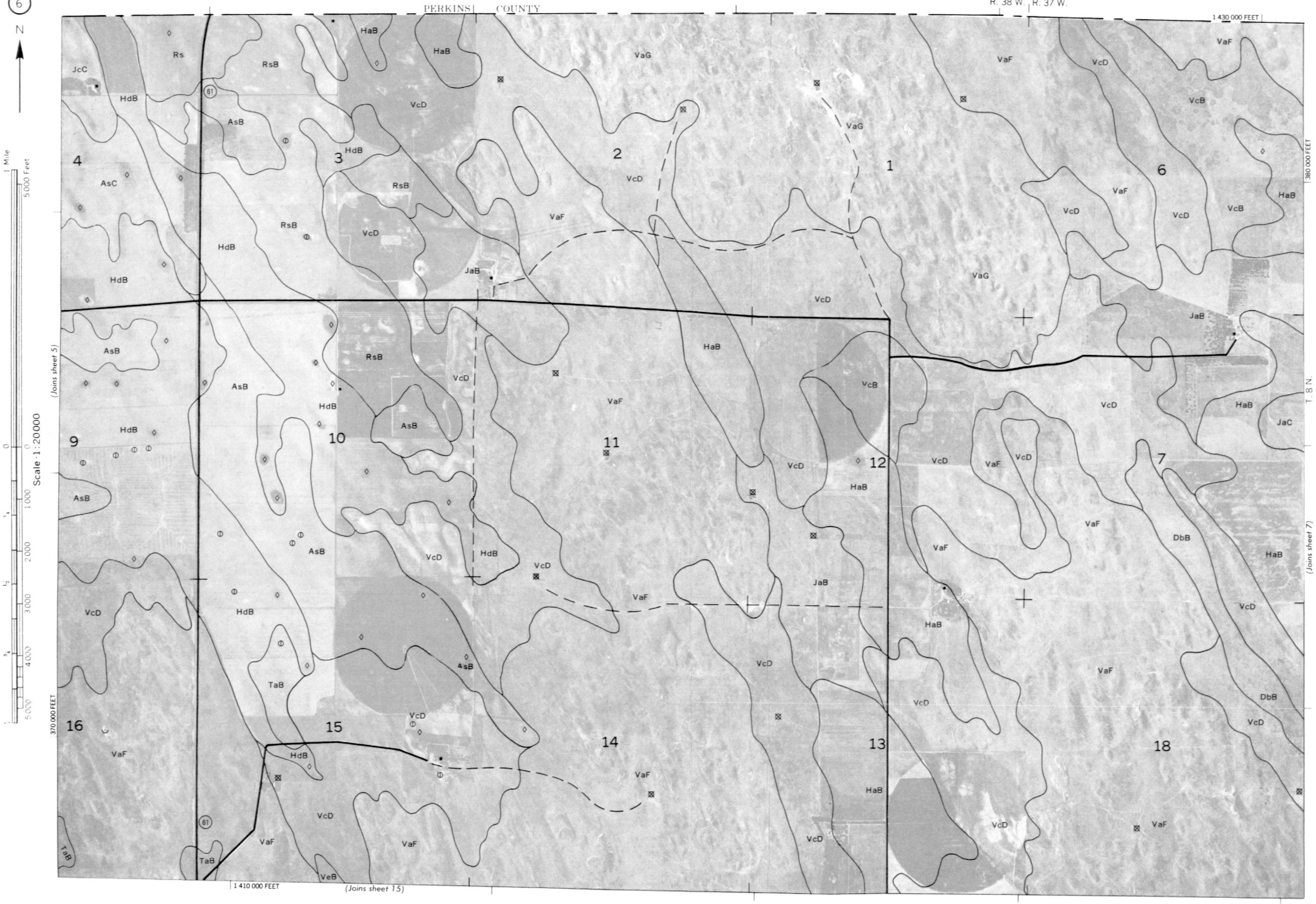

1
PERKINS COUNTY
R. 42 W. | R. 41 W.
1 295 000 FEET
385 000 FEET
COLORADO
PHILLIPS COUNTY
T. 8 N.
N
(Joins sheet 2)
(Joins sheet 10)
1 310 000 FEET
370 000 FEET
Scale 1:20000
1 Mile
5000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18
Ku
Mc
McB
Ma
MaB
Ac
AsB
AsC
Sc

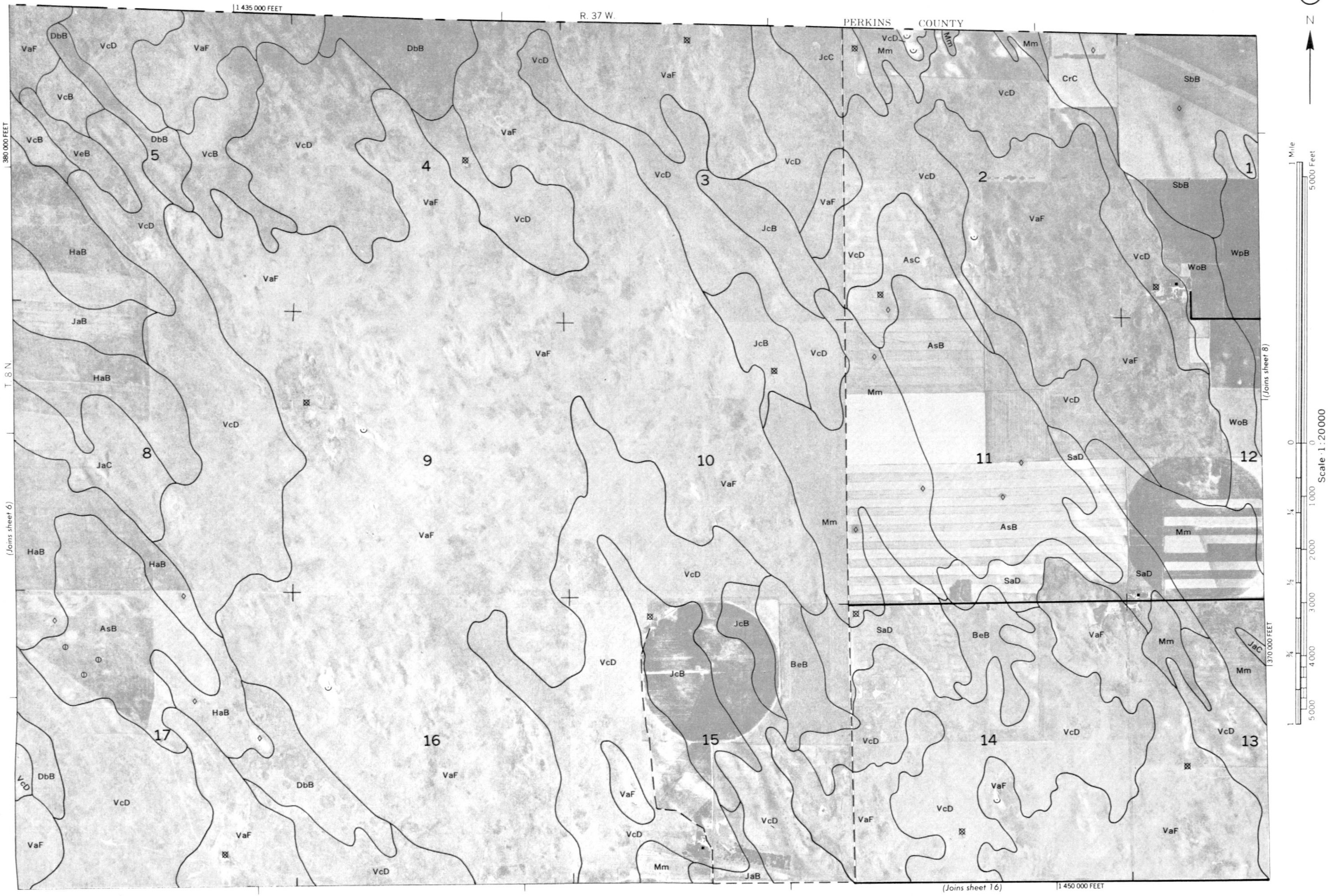

2
N
PERKINS COUNTY
R. 41 W.
R. 40 W.
1 335 000 FEET
385 000 FEET
T. 8 N.
(Joins sheet 1)
(Joins sheet 3)
(Joins sheet 11)
1 315 000 FEET
370 000 FEET
1 Mile
5 000 Feet
Scale 1:20000
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18
Sc
Ac
Mc
Ma
McB
Ku
OaF
RtD2
Rs
RtB
RtC
AsC
Gh
MaB

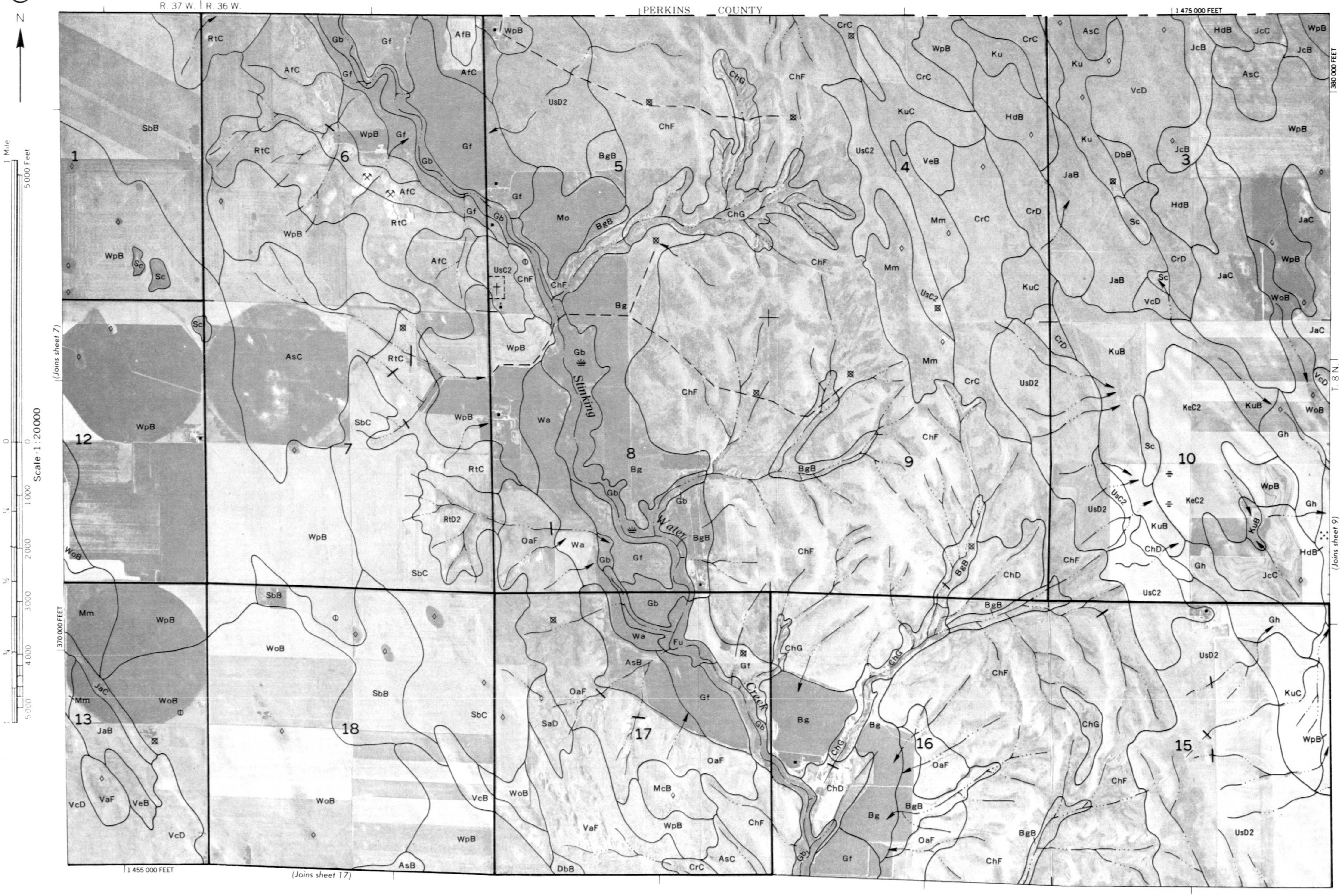

3
N
1 340 000 FEET
R. 40 W.
PERKINS COUNTY
385 000 FEET
T. 8 N.
(Joins sheet 2)
(Joins sheet 4)
(Joins sheet 12)
1 355 000 FEET
370 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
1000
2000
3000
4000
5000
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
Rs
Sc
Ma
RsB
RtB
TaB
VcD
VcB
DbB
DuC
JcB
HdB
VaF
VaG
RtC
RtD2
Gh
Mc
Ku
WpB

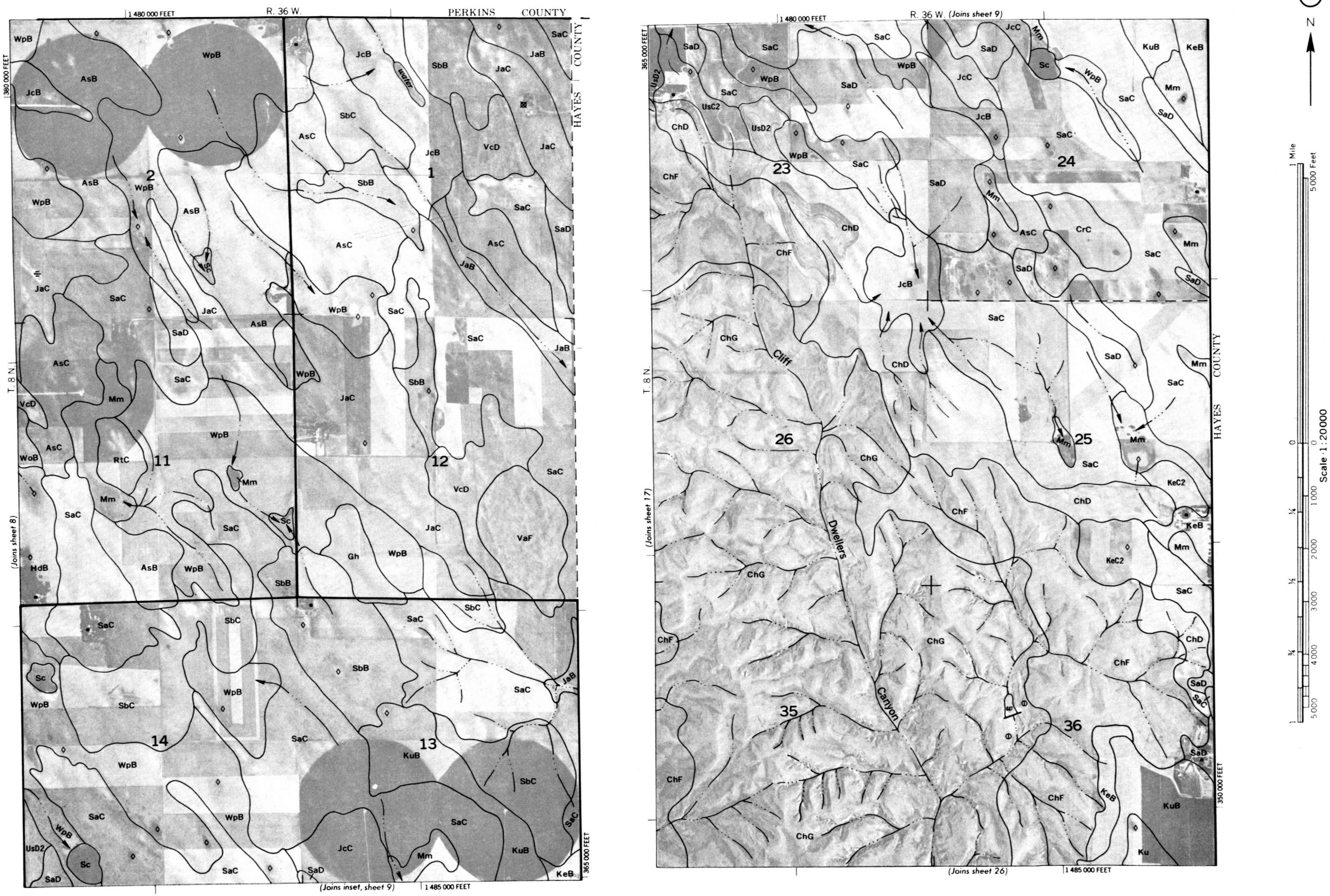

4
N
R. 40 W.
R. 39 W.
PERKINS COUNTY
1 380 000 FEET
380 000 FEET
370 000 FEET
1 360 000 FEET
T. 8 N.
(Joins sheet 3)
(Joins sheet 5)
(Joins sheet 13)
Scale 1:20000
1 Mile
5000 Feet
Spring Creek
1
3
4
5
6
7
8
9
10
12
13
15
16
17
18
VcD
TaF
DuC
Rs
HdB
TaB
RsB
VeB
VcB
VaG
VaF
DbB
BeB
JcB
OaF
JcC

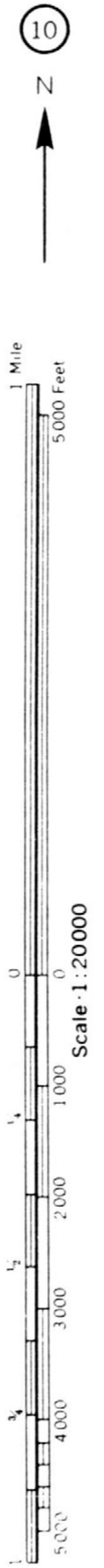

5
N
1 385 000 FEET
R. 39 W.
R. 38 W.
PERKINS COUNTY
380 000 FEET
T. 8 N.
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 14)
370 000 FEET
1 405 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
Spring
Creek
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18
VaF
VaG
VcB
VcD
VeB
RtC
JcC
JcB
RsB
Rs
Sc
HdB
Ku
AsC
AsB
RtB
TaF
TaB
DuC
DbB
HdB
JcB


6
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
PERKINS
COUNTY
R. 38 W.
R. 37 W.
1 430 000 FEET
380 000 FEET
370 000 FEET
1 410 000 FEET
T. 8 N.
(Joins sheet 5)
(Joins sheet 7)
(Joins sheet 15)
61
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18
JcC
Rs
RsB
HaB
HdB
AsB
AsC
VaG
VaF
VcD
VcB
JaB
JaC
DbB
TaB
VeB

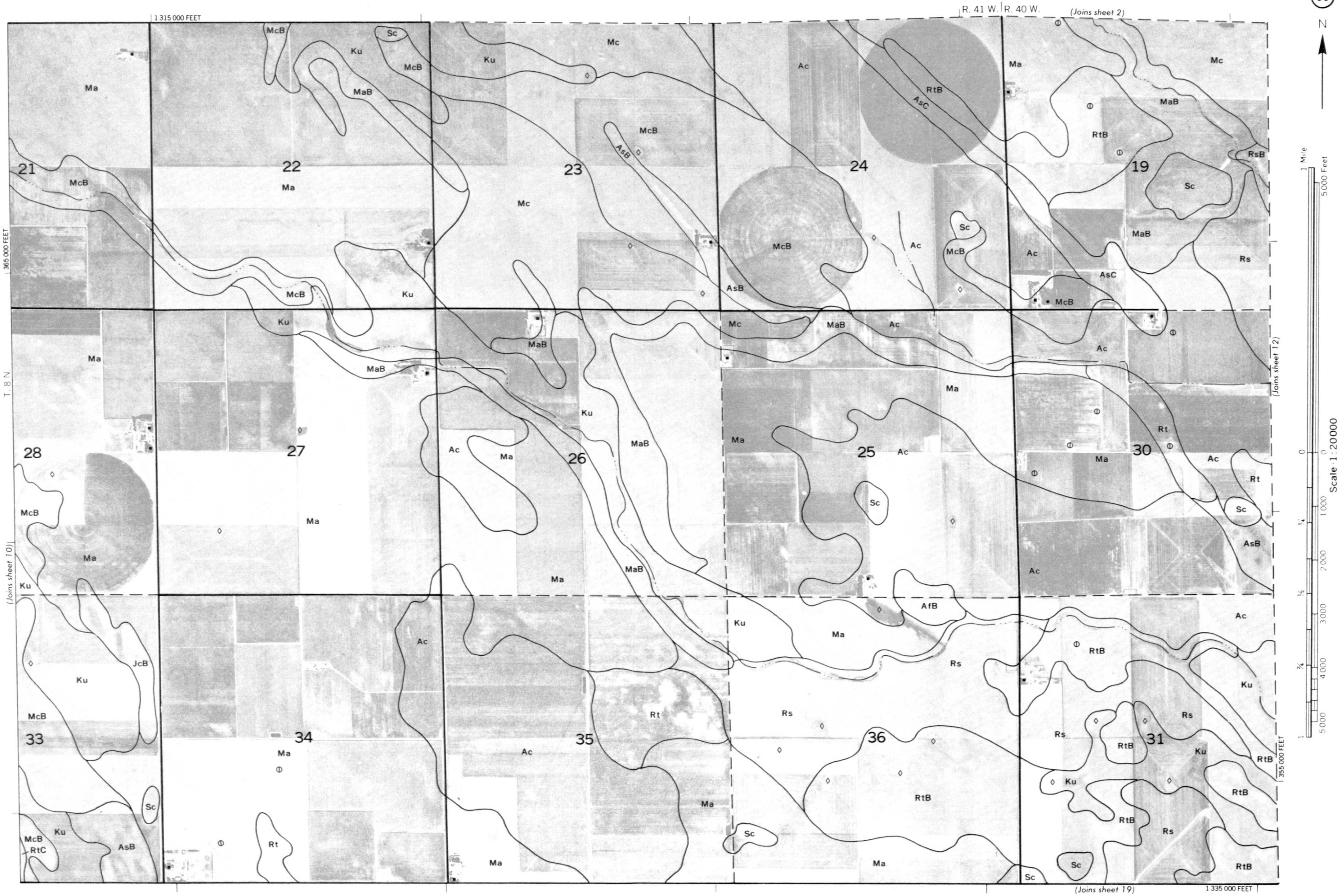

7
N
1 435 000 FEET
R. 37 W.
PERKINS COUNTY
380 000 FEET
T. 8 N.
(Joins sheet 6)
(Joins sheet 8)
370 000 FEET
(Joins sheet 16)
1 450 000 FEET
Scale 1:20000
1 Mile
5000 Feet
VaF
DbB
VcD
VcB
VeB
DbB
HaB
JaB
JaC
AsB
HaB
JcC
JcB
AsC
CrC
SbB
WpB
WoB
Mm
SaD
BeB
JaC
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17


8
N
R. 37 W.
R. 36 W.
PERKINS COUNTY
1 475 000 FEET
380 000 FEET
T. 8 N.
(Joins sheet 7)
(Joins sheet 9)
(Joins sheet 17)
370 000 FEET
1 455 000 FEET
1 Mile
5000 Feet
Scale 1:20000
Stinking Water Creek
1
3
4
5
6
7
8
9
10
12
13
15
16
17
18
SbB
WpB
RtC
AfC
AfB
Gb
Gf
UsD2
ChF
ChG
BgB
Mo
UsC2
AsC
Sc
SbC
RtD2
OaF
Wa
Bg
Fu
WoB
Mm
JaC
JaB
VcD
VaF
VeB
McB
SaD
VcB
DbB
CrC
CrD
Ku
KuC
KuB
HdB
JcB
JcC
VeB
DbB
KeC2
Gh
ChD
UsC2
KuC

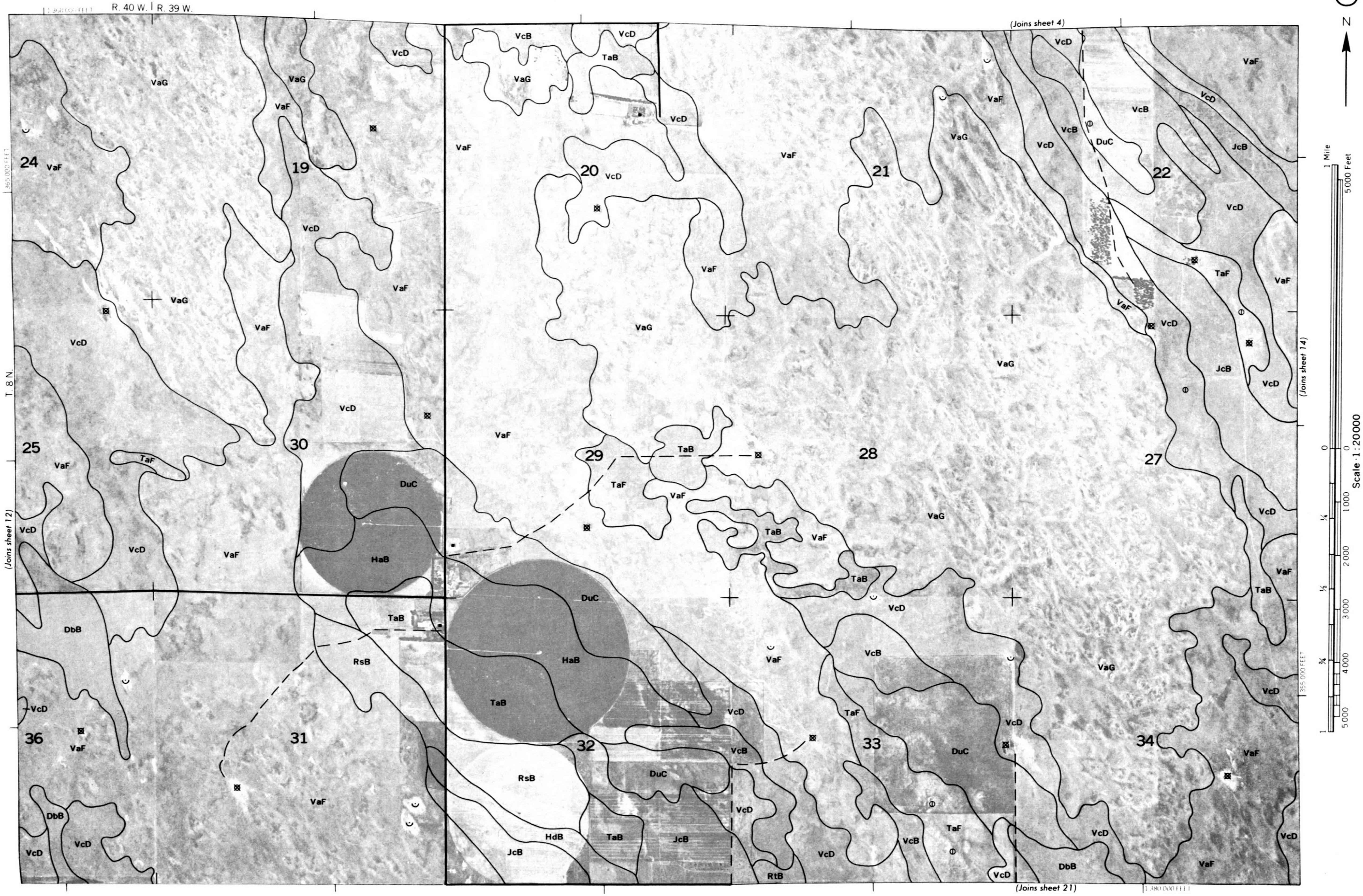

1 480 000 FEET
R. 36 W.
PERKINS COUNTY
HAYES COUNTY
380 000 FEET
T. 8 N.
(Joins sheet 8)
(Joins inset, sheet 9)
1 485 000 FEET
365 000 FEET
R. 36 W. (Joins sheet 9)
(Joins sheet 17)
(Joins sheet 26)
350 000 FEET
Cliff Dwellers Canyon
N
1 Mile
5000 Feet
Scale 1:20000


10
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000


(Joins sheet 1)
R. 42 W.
R. 41 W.
1 310 000 FEET
365 000 FEET
T. 8 N.
(Joins sheet 11)
(Joins sheet 18)
1 295 000 FEET
355 000 FEET
PHILLIPS COUNTY COLORADO
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
Ac
Ku
KuB
KuC
AsC
RtC
Mc
McB
Sc
Ma
Rs
Rt
RtB
AfB
Gh
RtD2

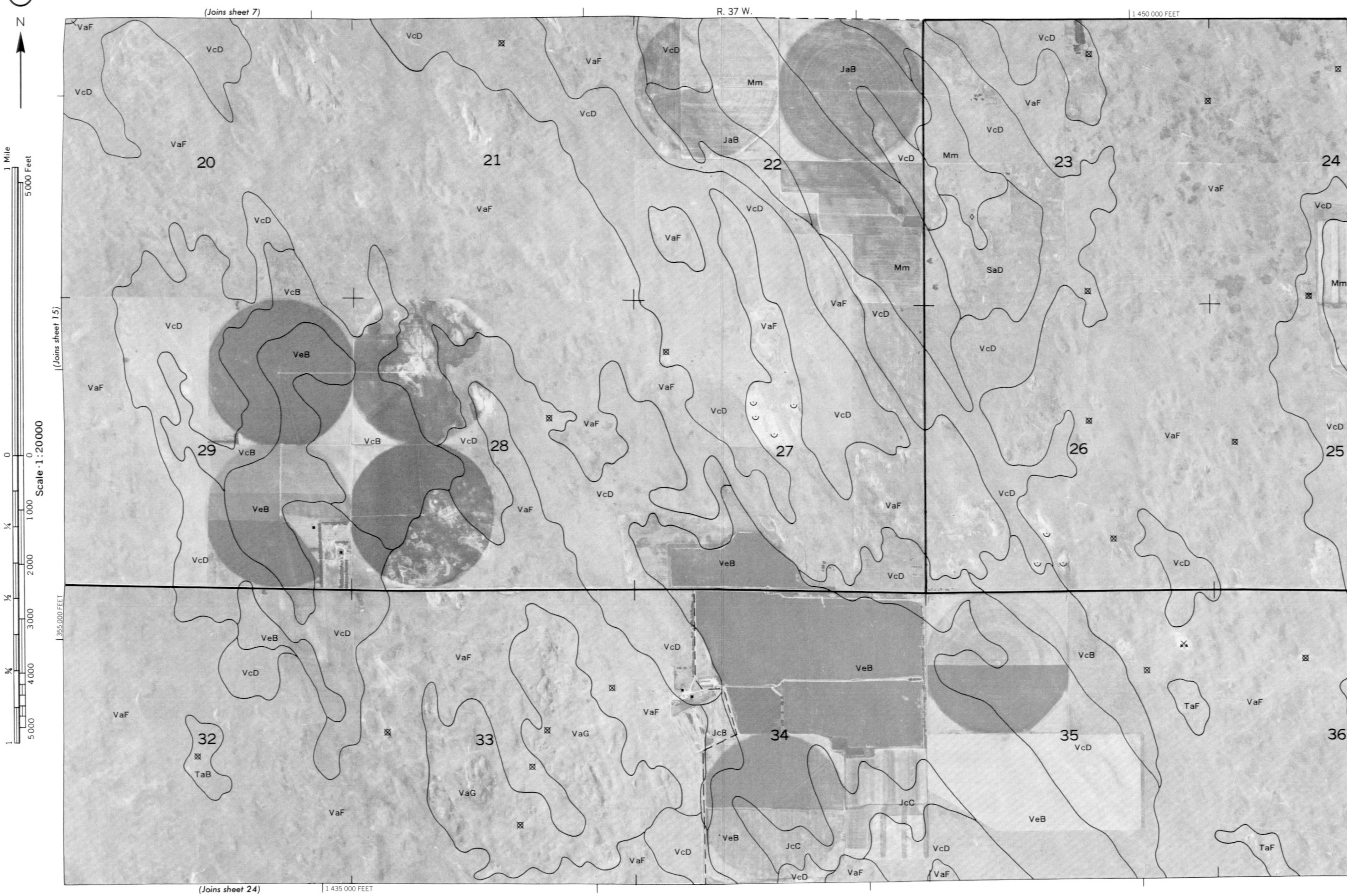

11
N
R. 41 W.
R. 40 W.
(Joins sheet 2)
1 315 000 FEET
365 000 FEET
T. 8 N.
(Joins sheet 10)
(Joins sheet 12)
355 000 FEET
1 335 000 FEET
(Joins sheet 19)
1 Mile
5000 Feet
Scale 1:20000
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31
Ma
McB
Sc
Ku
MaB
Mc
AsB
Ac
RtB
AsC
RsB
Rs
AfB
Rt
JcB
RtC


12
N
(Joins sheet 3)
R. 40 W.
1 355 000 FEET
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 11)
(Joins sheet 13)
365 000 FEET
T. 8 N.
355 000 FEET
(Joins sheet 20)
1 340 000 FEET
intermittent
20
21
22
23
24
29
28
27
26
25
32
33
34
35
36
Mc
Gh
RtD2
RsB
Rs
RtC
RtB
Ku
HdB
VaF
VcD
WpB
VaG
Sc
Rt
Ac
AsC
AsB
TaB
VcB
DbB

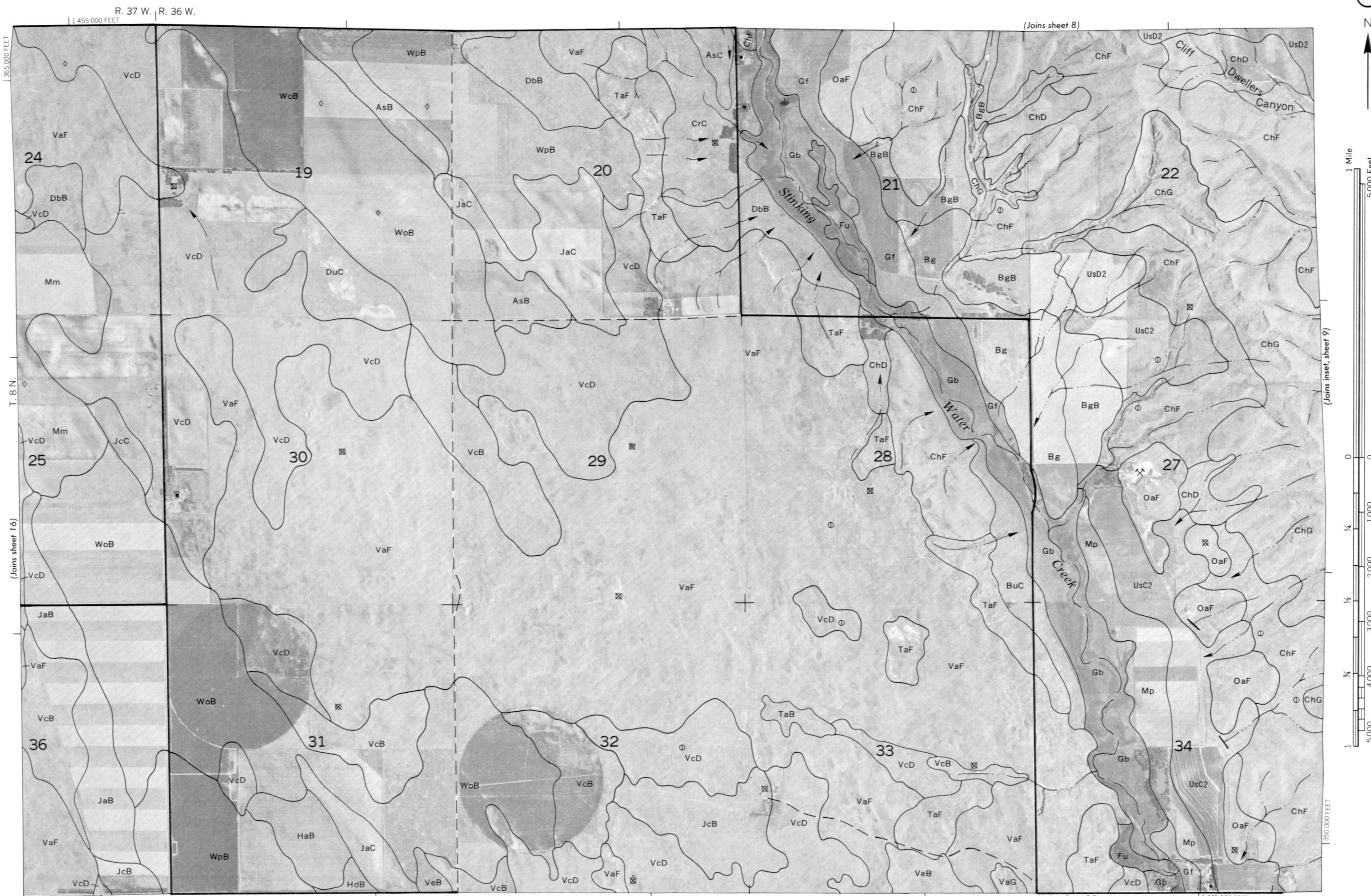

13
N
R. 40 W.
R. 39 W.
T. 8 N.
(Joins sheet 4)
(Joins sheet 12)
(Joins sheet 14)
(Joins sheet 21)
Scale 1:20000
1 Mile
5000 Feet
24
25
36
19
30
31
20
29
32
21
28
33
22
27
34
VaG
VaF
VcD
VcB
TaB
TaF
DuC
HaB
DbB
RsB
JcB
HdB
RtB

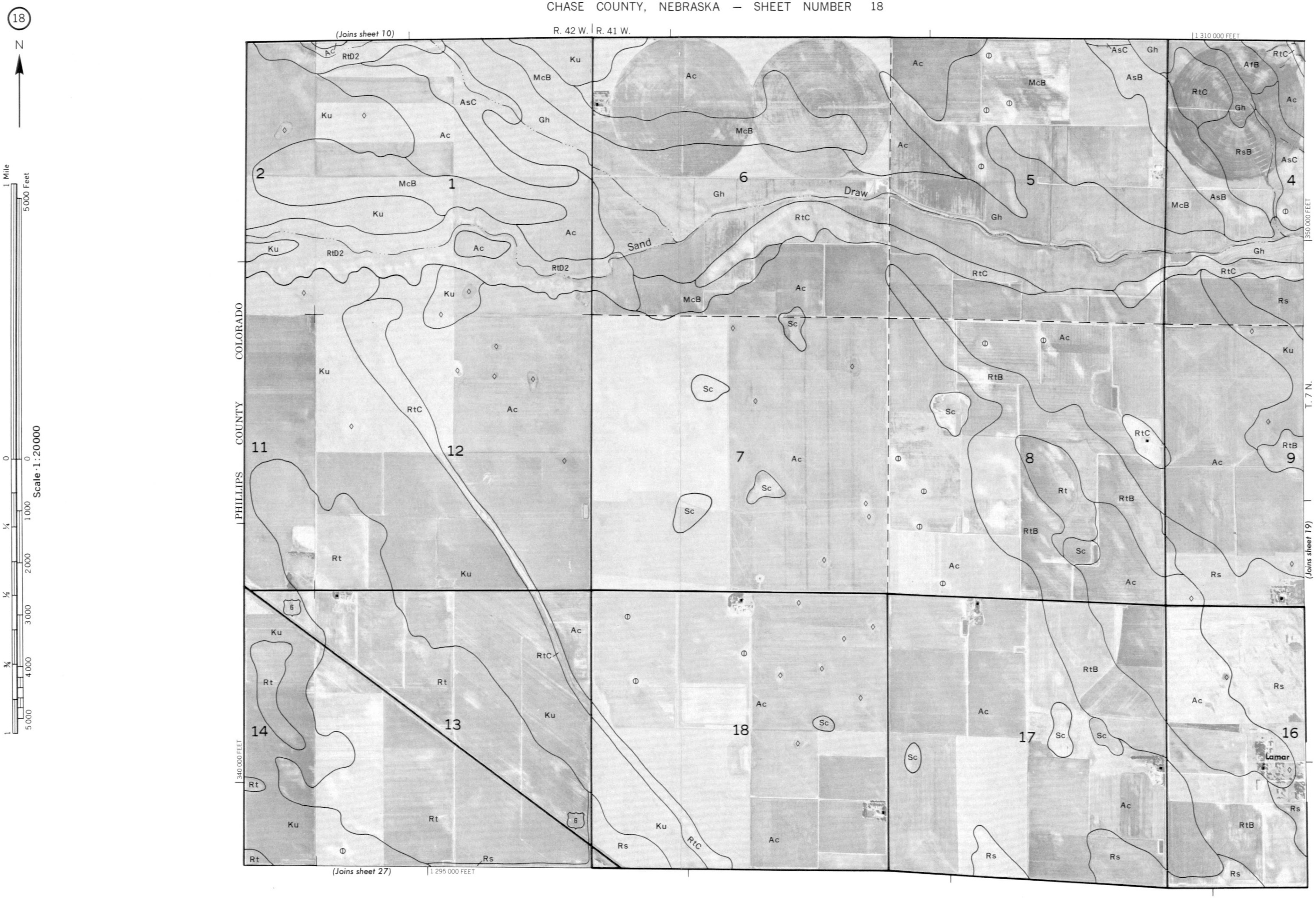

N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 5)
R. 39 W.
R. 38 W.
1 405 000 FEET
365 000 FEET
355 000 FEET
(Joins sheet 13)
(Joins sheet 15)
(Joins sheet 22)
T. 8 N.
Spring
Creek
19
20
21
23
24
25
26
28
29
30
31
32
33
35
36
JcB
VaF
VcD
VcB
HdB
TaF
DbB
VaG
DuC
VeB
AsB
HaB
TaB
BeB
RsB
Wa
OaF
WpB
CrB

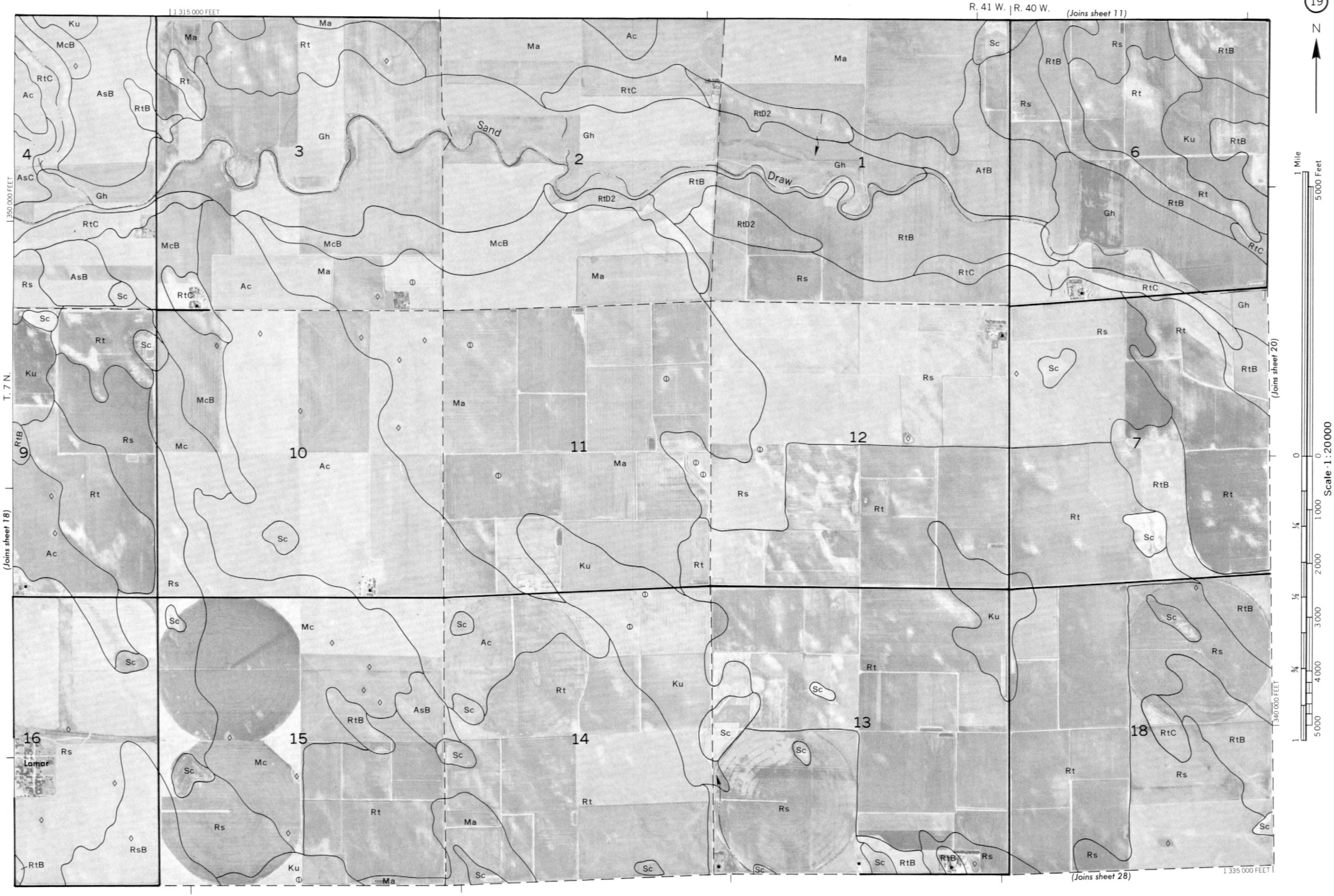

15
N
1 410 000 FEET
R. 38 W.
R. 37 W.
(Joins sheet 6)
(Joins sheet 14)
(Joins sheet 16)
(Joins sheet 23)
365 000 FEET
355 000 FEET
1 430 000 FEET
T. 8 N.
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31
VaF
VeB
VcD
VcB
HaB
DuC
AsB
HdB
JaB
JaC
JcB
JcB
TaB
TaF
DbB
Wa
61

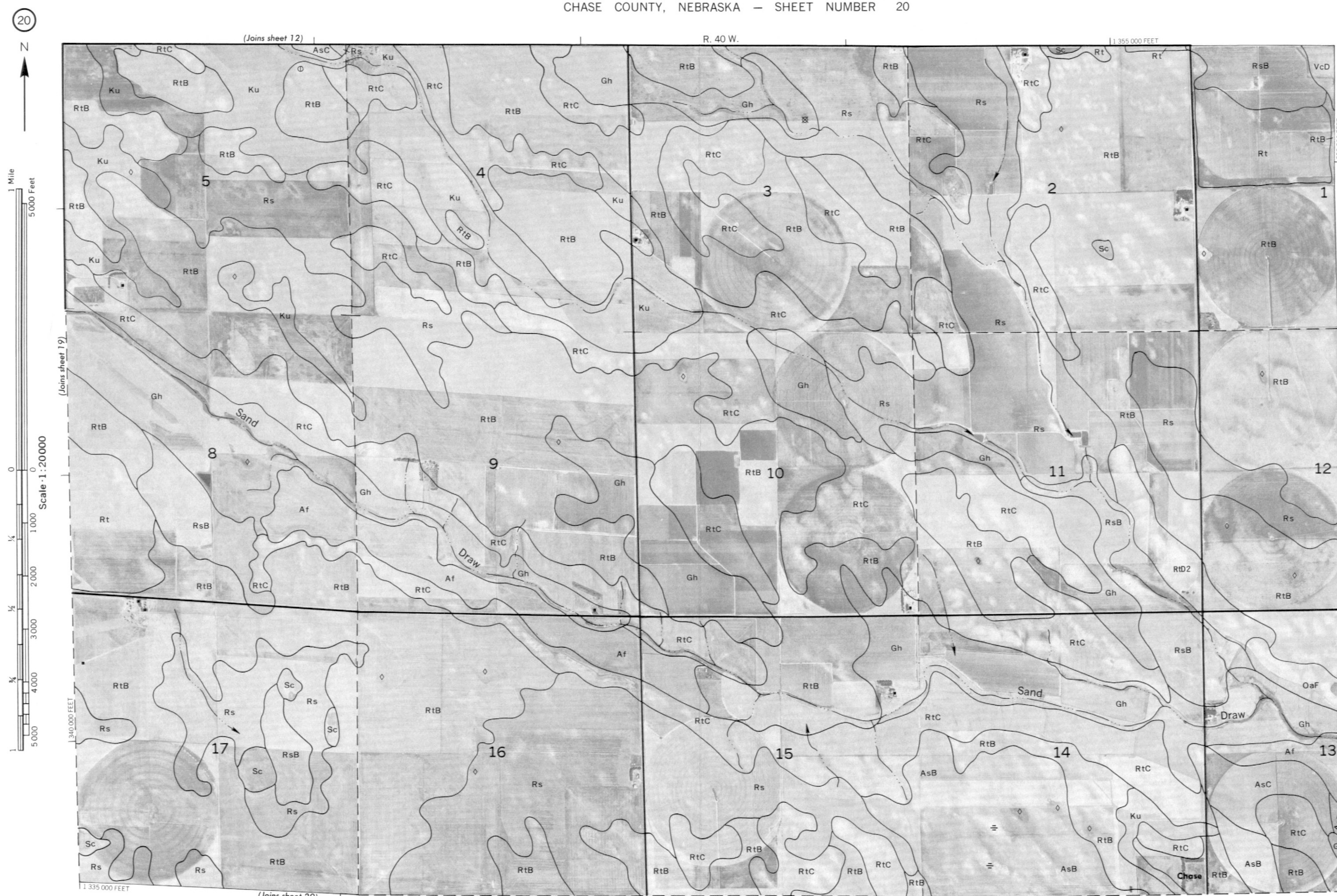

16
N
(Joins sheet 7)
R. 37 W.
1 450 000 FEET
365 000 FEET
(Joins sheet 15)
(Joins sheet 17)
T. 8 N.
355 000 FEET
1 435 000 FEET
(Joins sheet 24)
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
20
21
22
23
24
29
28
27
26
25
32
33
34
35
36
VaF
VcD
VcB
VeB
VaG
JaB
JcB
JcC
Mm
SaD
TaF
TaB

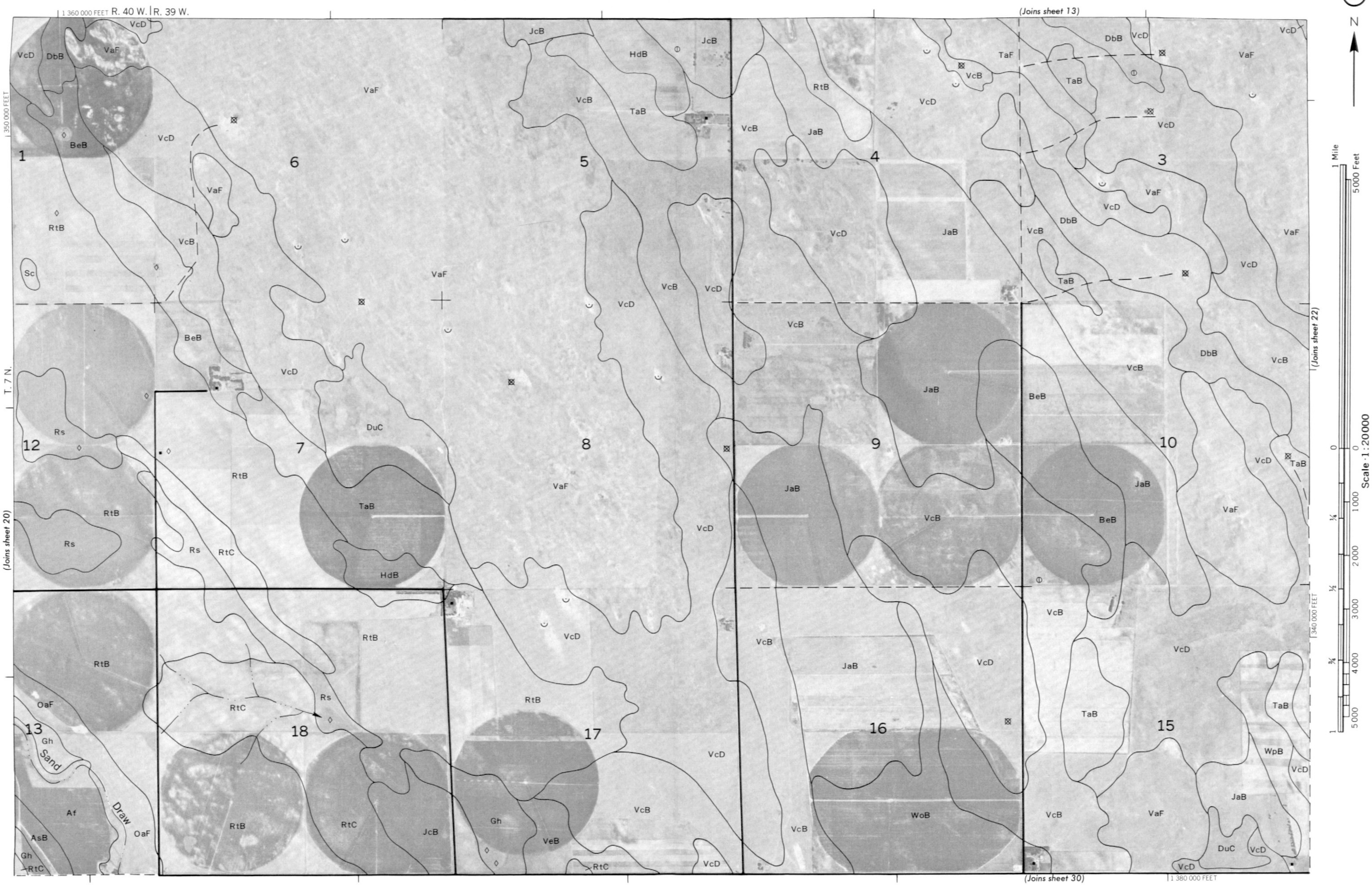
CHASE COUNTY, NEBRASKA — SHEET NUMBER 17

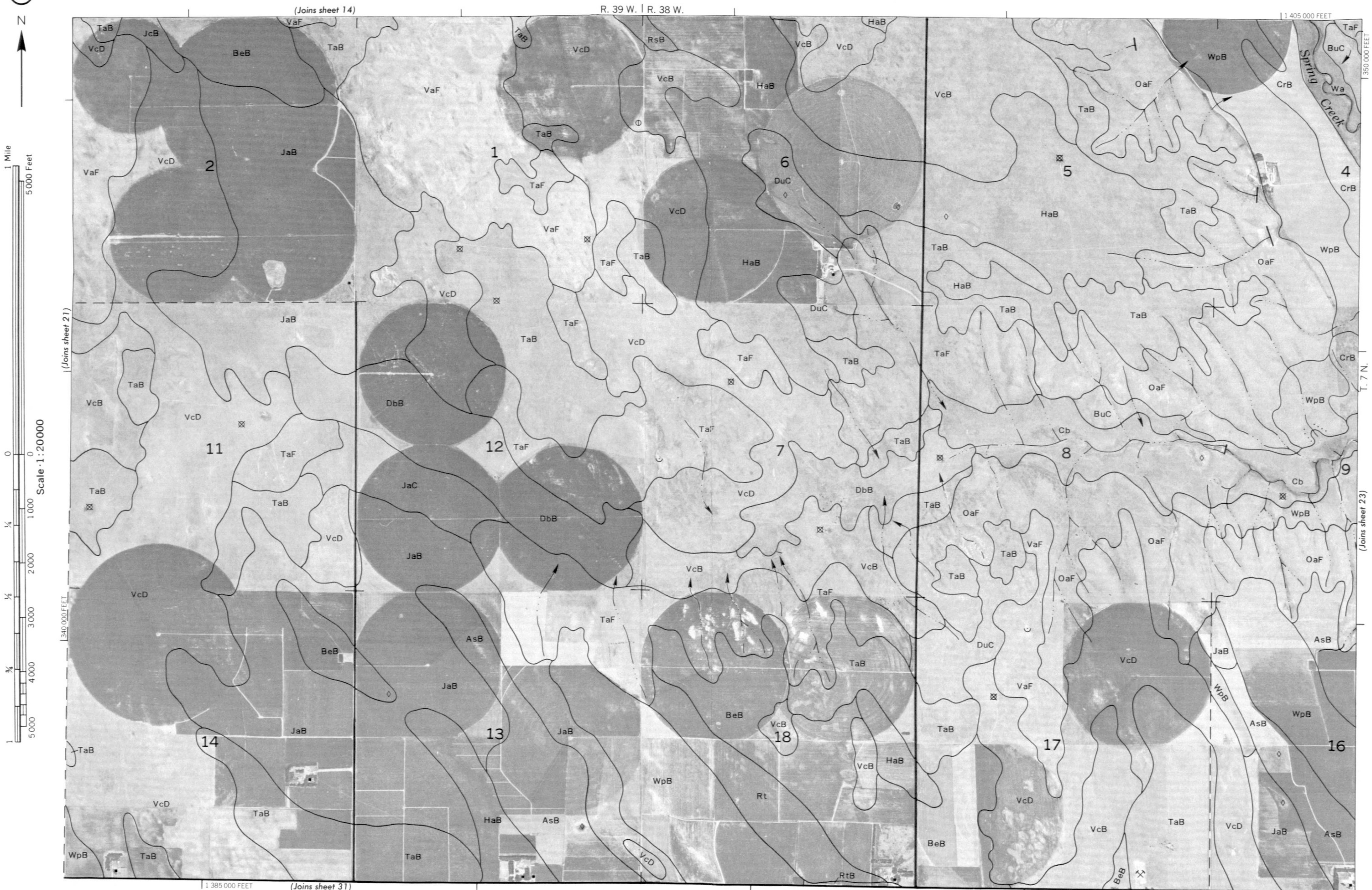


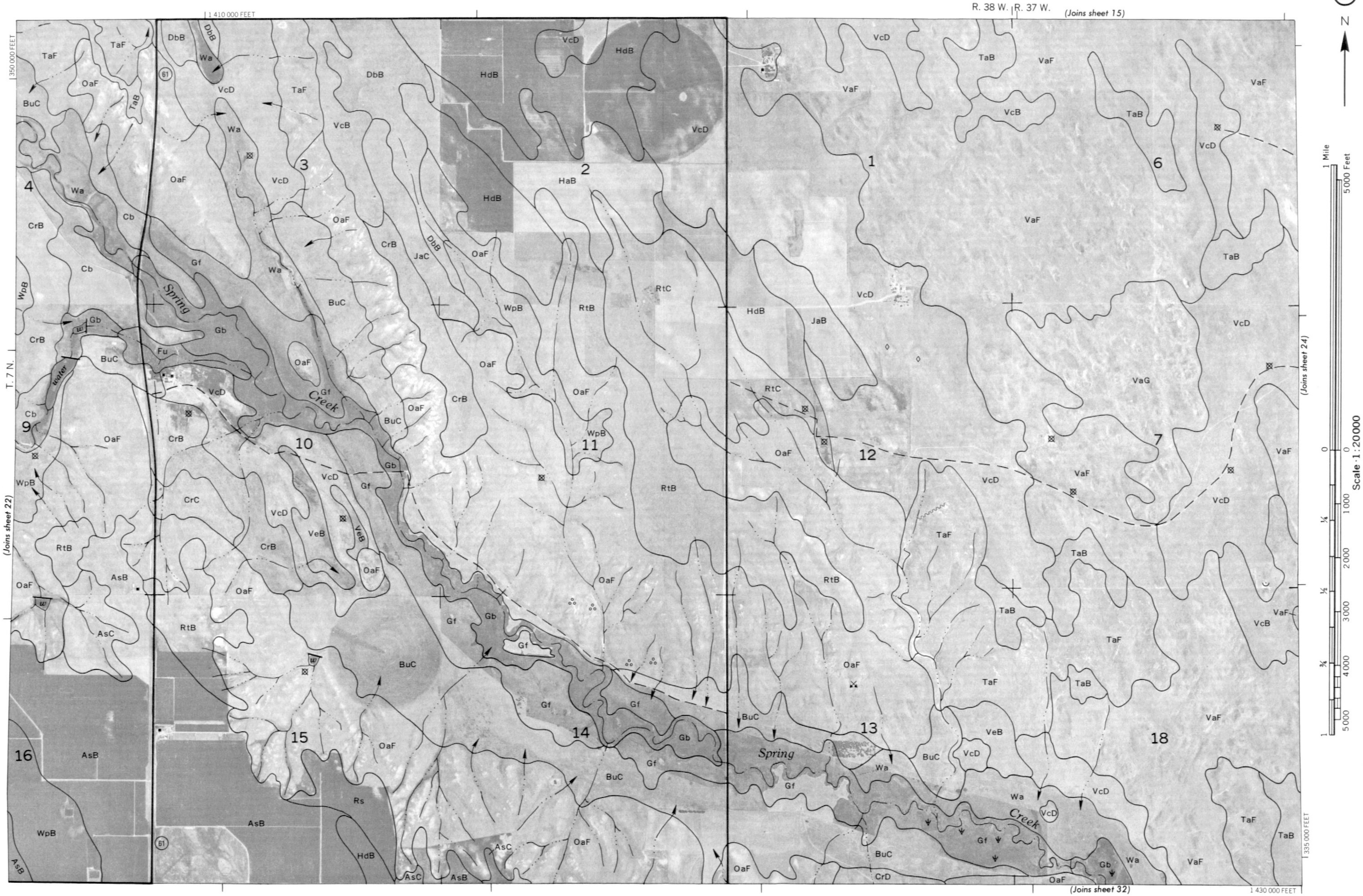

18
N
1 Mile
5000 Feet
Scale 1:20000
(Joins sheet 10)
R. 42 W. | R. 41 W.
1 310 000 FEET
COLORADO
PHILLIPS COUNTY
T. 7 N.
350 000 FEET
(Joins sheet 19)
340 000 FEET
(Joins sheet 27)
1 295 000 FEET
Sand Draw
Lamar
Ac
Ku
McB
AsC
Gh
RtD2
RtC
RtB
Rt
Rs
RsB
AsB
AfB
Sc
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18

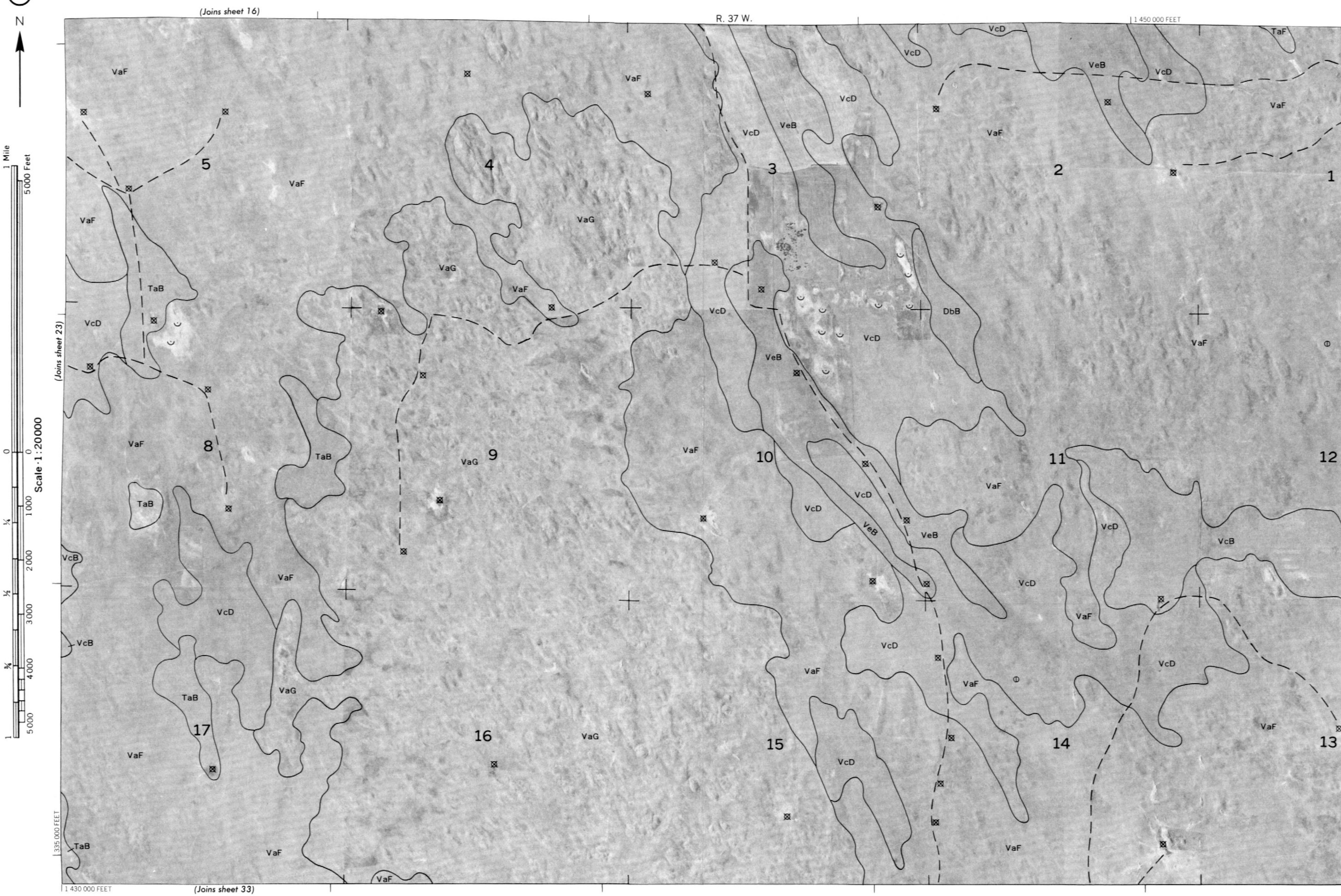

19
N
(Joins sheet 11)
(Joins sheet 20)
(Joins sheet 28)
(Joins sheet 18)
R. 41 W.
R. 40 W.
T. 7 N.
1 315 000 FEET
350 000 FEET
340 000 FEET
1 335 000 FEET
Sand
Draw
Lamar
Scale 1:20000
1 Mile
5000 Feet

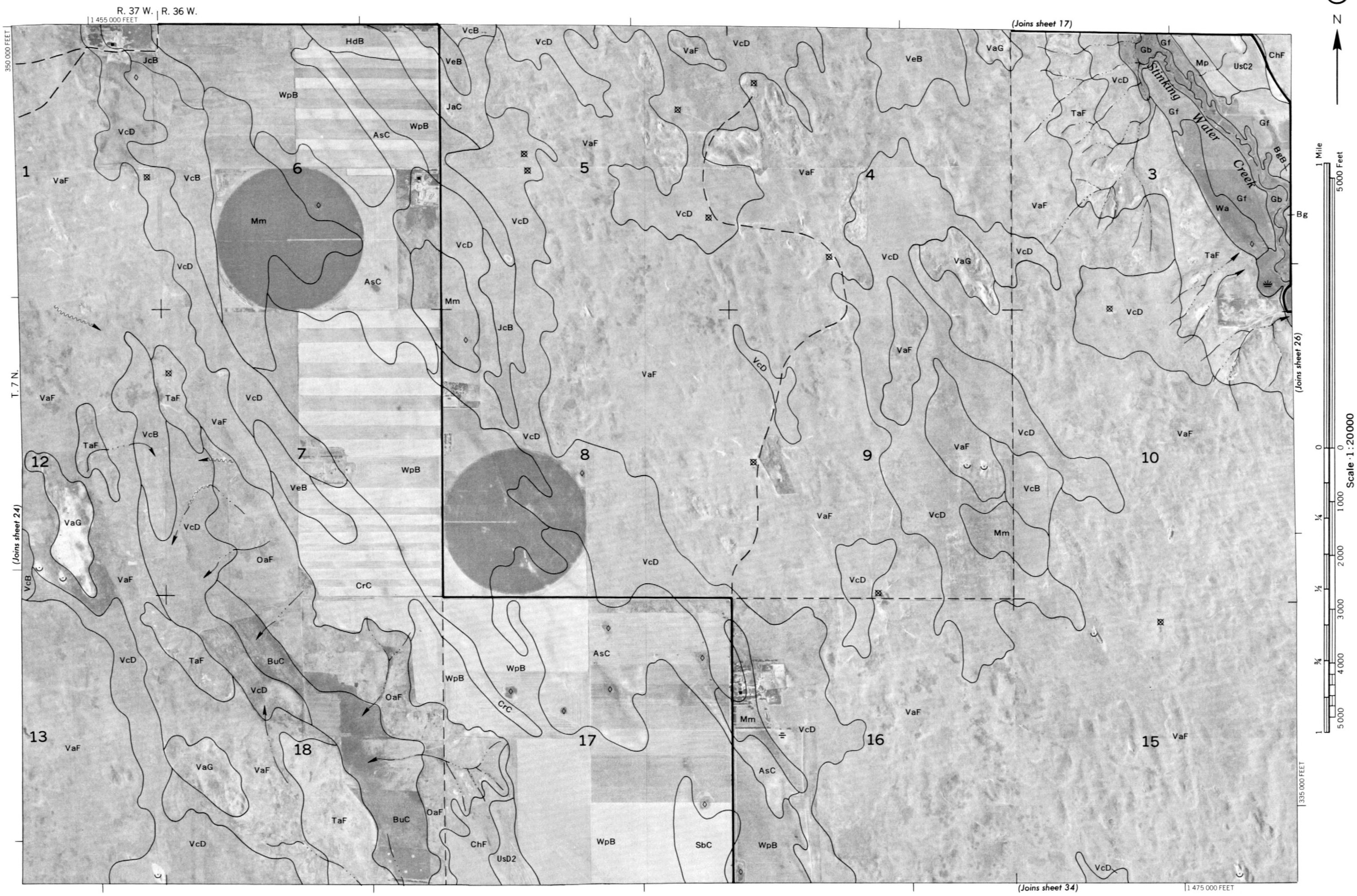

20
N
(Joins sheet 12)
R. 40 W.
1 355 000 FEET
350 000 FEET
T. 7 N.
(Joins sheet 21)
(Joins sheet 19)
(Joins sheet 29)
1 335 000 FEET
340 000 FEET
Sand
Draw
Sand
Draw
Chase
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17

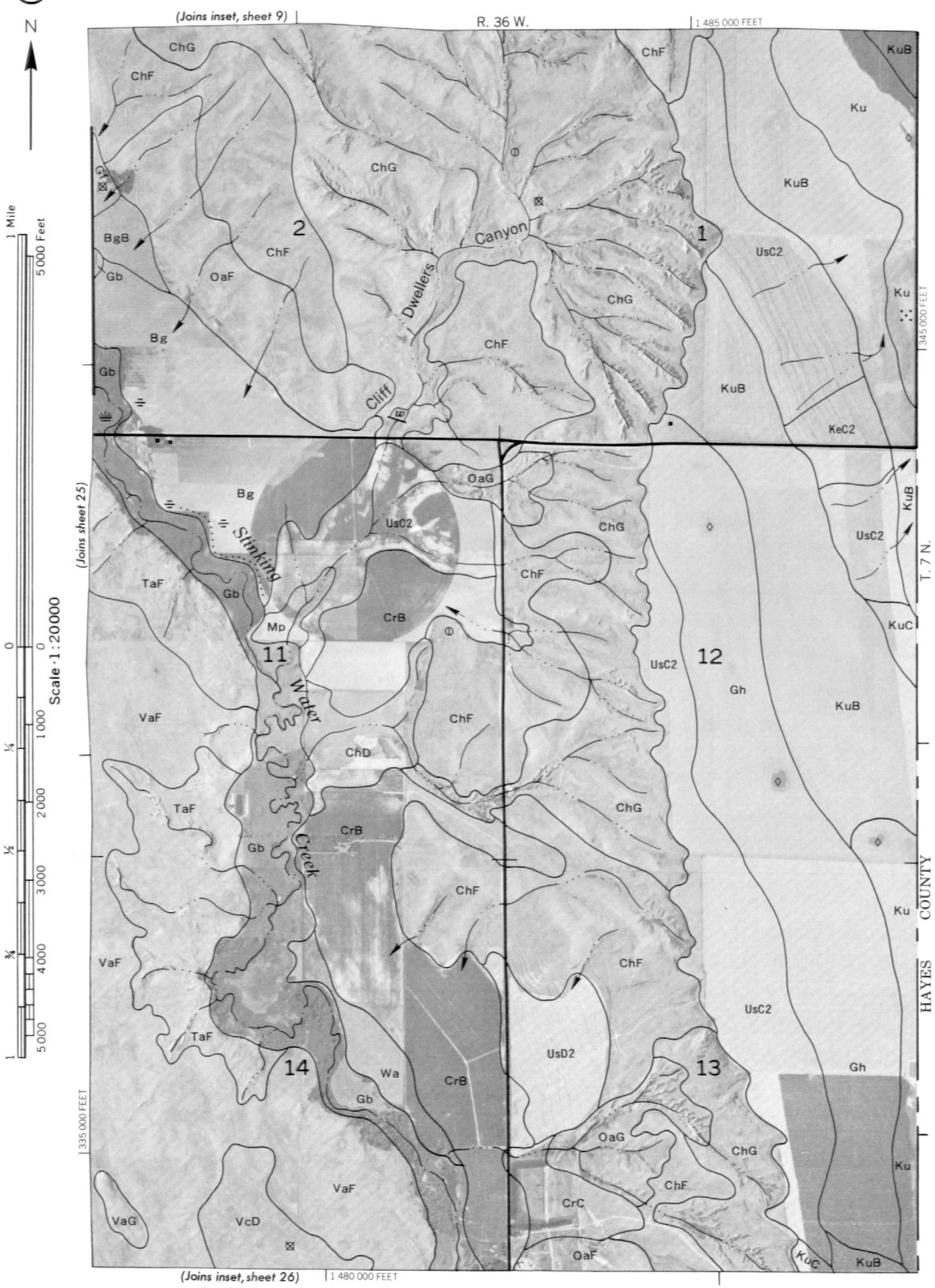

21
N
1 360 000 FEET
R. 40 W.
R. 39 W.
(Joins sheet 13)
350 000 FEET
T. 7 N.
(Joins sheet 20)
(Joins sheet 22)
(Joins sheet 30)
340 000 FEET
1 380 000 FEET
1 Mile
5000 Feet
Scale 1:20 000
0
1/4
1/2
3/4
1
0
1000
2000
3000
4000
5000
1
2
3
4
5
6
7
8
9
10
12
13
15
16
17
18
VcD
DbB
VaF
BeB
RtB
Sc
VcB
JcB
HdB
TaB
TaF
JaB
RtB
DbB
BeB
Rs
DuC
HdB
RtC
OaF
Gh
Sand
Draw
Af
AsB
RtC
VeB
WoB
WpB
DuC
VcD


N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
(Joins sheet 14)
R. 39 W.
R. 38 W.
1 405 000 FEET
350 000 FEET
(Joins sheet 21)
T. 7 N.
(Joins sheet 23)
340 000 FEET
1 385 000 FEET
(Joins sheet 31)
Spring
Creek
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18
TaB
JcB
VaF
VcD
BeB
JaB
TaF
HaB
RsB
VcB
DuC
WpB
CrB
BuC
Wa
OaF
DbB
JaC
Cb
AsB
Rt
RtB

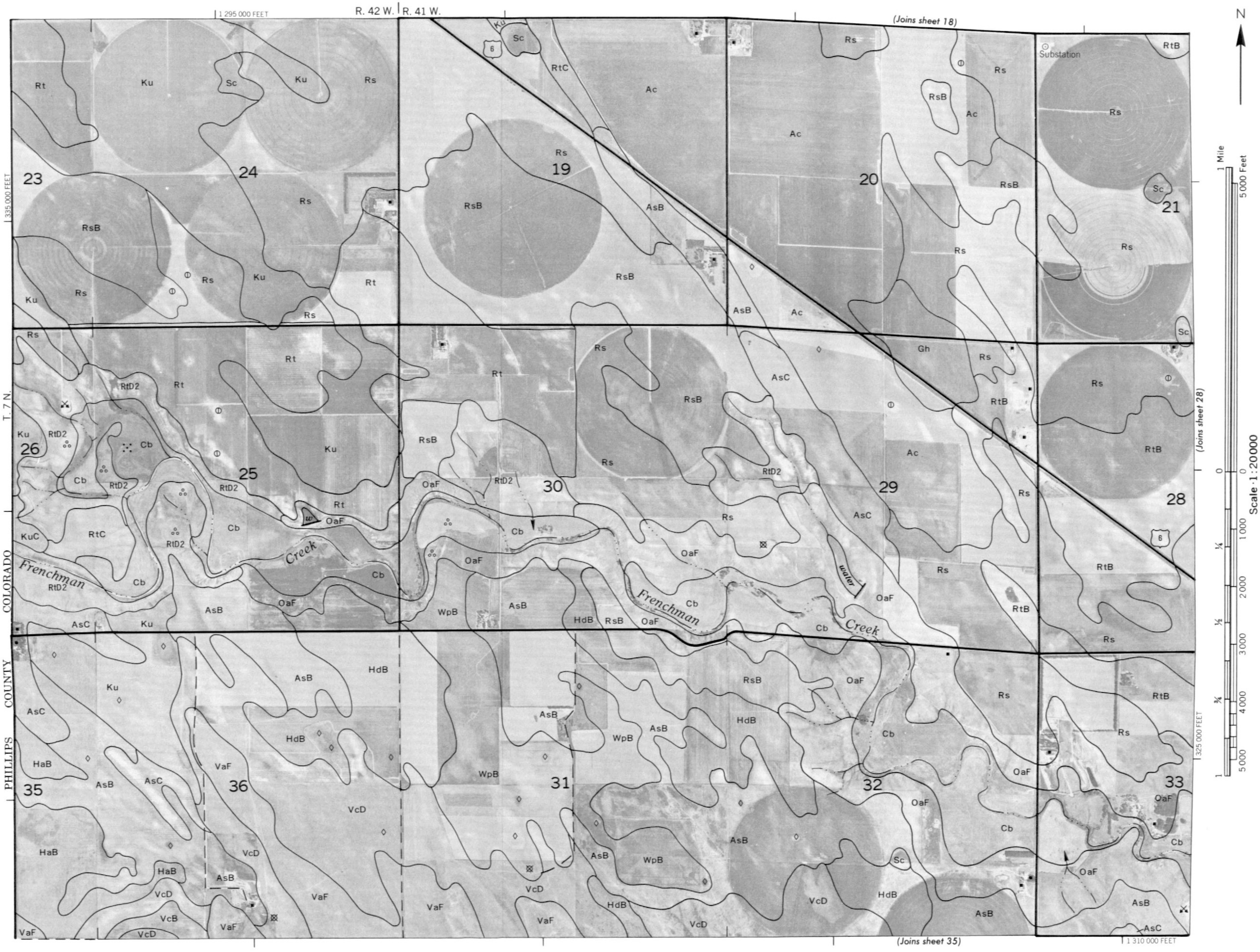

23
N
R. 38 W. R. 37 W.
(Joins sheet 15)
(Joins sheet 22)
(Joins sheet 24)
(Joins sheet 32)
1 410 000 FEET
1 430 000 FEET
350 000 FEET
335 000 FEET
T. 7 N.
Spring Creek
water
Scale 1:20000
1 Mile
5000 Feet
0 ¼ ½ ¾ 1
0 1000 2000 3000 4000 5000
1 2 3 4 6 7 9 10 11 12 13 14 15 16 18
TaF OaF BuC TaB Wa Cb CrB WpB Gb Fu DbB VcD VcB JaC HdB HaB RtB RtC JaB VaF VaG VeB CrC RtB AsB AsC Gf BuC Rs CrD OaF

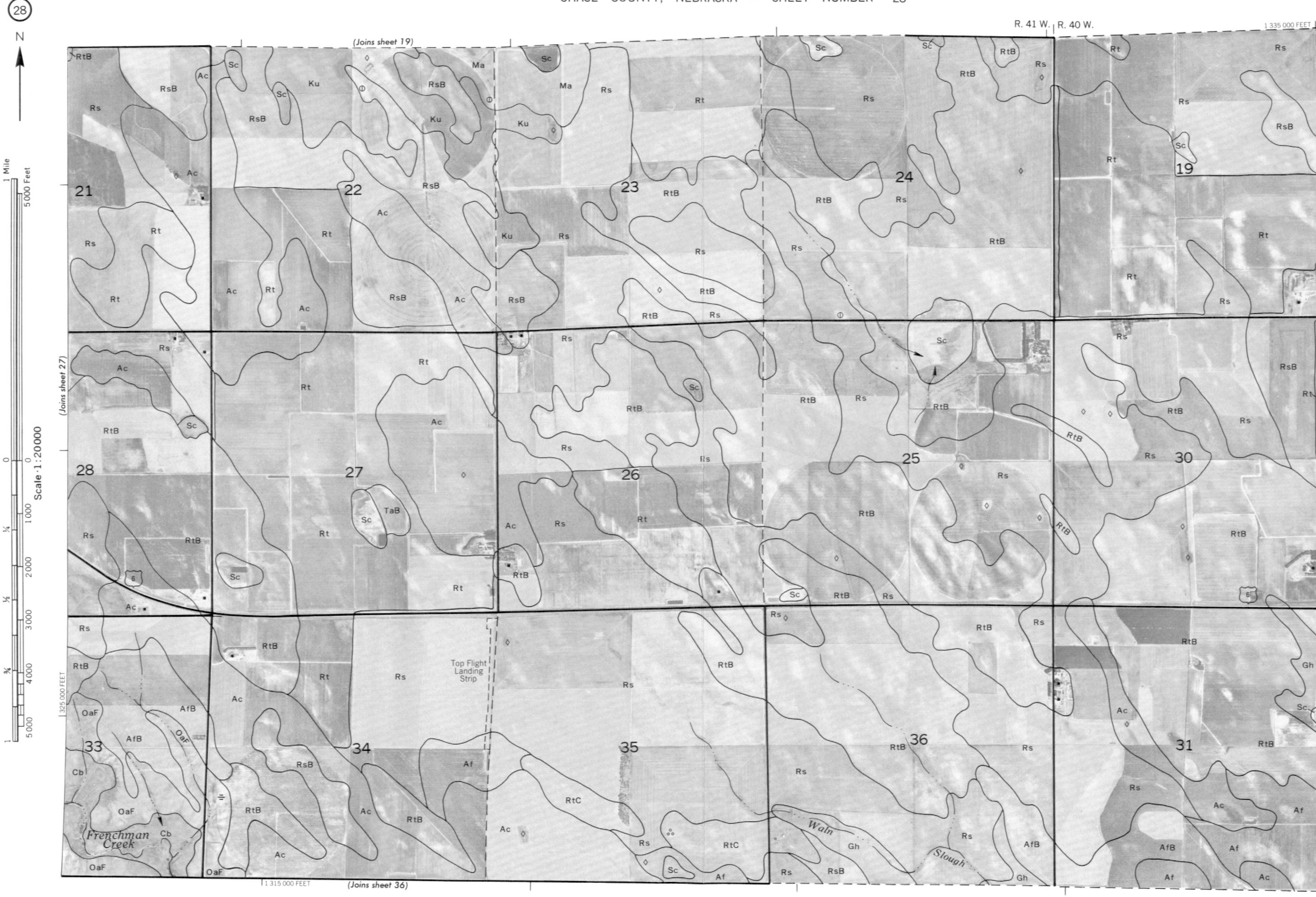

24
N
(Joins sheet 16)
R. 37 W.
1 450 000 FEET
350 000 FEET
T. 7 N.
(Joins sheet 23)
(Joins sheet 25)
(Joins sheet 33)
1 430 000 FEET
335 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
VaF
VaG
VcD
VeB
VcB
TaB
TaF
DbB


R. 37 W.
R. 36 W.
1 455 000 FEET
350 000 FEET
(Joins sheet 17)
N
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
Scale 1:20000
(Joins sheet 24)
(Joins sheet 26)
(Joins sheet 34)
1 475 000 FEET
335 000 FEET
T. 7 N.
Stinking
Water
Creek
1
6
5
4
3
7
8
9
10
12
13
18
17
16
15
JcB
HdB
VcB
VcD
VaF
VeB
VaG
Gb
Gf
Mp
UsC2
ChF
WpB
JaC
AsC
TaF
BeB
Mm
Wa
Bg
JcB
TaF
VcB
OaF
CrC
BuC
WpB
ChF
UsD2
SbC

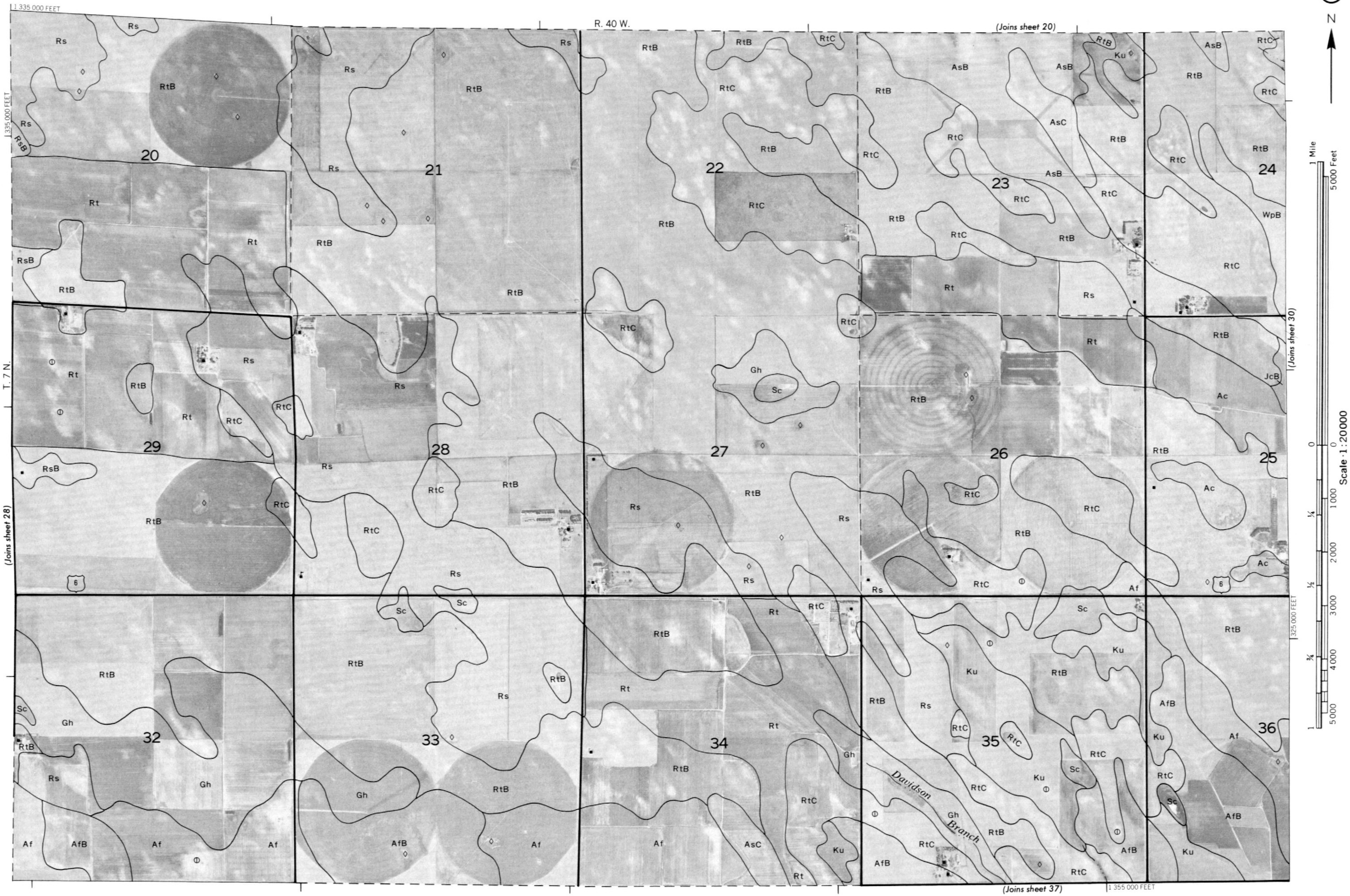

N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins inset, sheet 9)
R. 36 W.
1 485 000 FEET
(Joins sheet 25)
345 000 FEET
335 000 FEET
T. 7 N.
HAYES COUNTY
(Joins inset, sheet 26)
1 480 000 FEET
Dwellers
Canyon
Cliff
Stinking
Water
Creek
2
1
11
12
13
14
ChG
ChF
OaF
BgB
Gb
Bg
KuB
Ku
UsC2
KeC2
CrB
Mp
VaF
TaF
ChD
Gh
KuC
UsD2
Wa
OaG
CrC
VaG
VcD


(Joins sheet 26)
R. 36 W.
1 485 000 FEET
(Joins sheet 34)
330 000 FEET
320 000 FEET
T. 7 N.
HAYES COUNTY
(Joins sheet 43)
1 480 000 FEET
Stinking
Water
Creek
23
24
25
26
35
36
VaF
VcD
VaG
CrB
Gb
OaF
ChF
ChG
Ku
KuB
KuC
UsD2
Mm
Mo
VeB
SaD
SaC
Gf
OaG
BgB
Mp
UsC2
VeB
VaF


1 295 000 FEET
R. 42 W.
R. 41 W.
(Joins sheet 18)
N
Substation
T. 7 N.
(Joins sheet 28)
COLORADO
PHILLIPS
COUNTY
Frenchman
Creek
Frenchman
Creek
water
w
335 000 FEET
325 000 FEET
(Joins sheet 35)
1 310 000 FEET
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
6
6
1 Mile
5000 Feet
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
Scale 1:20000
Rt
Ku
Sc
Ku
Rs
RtC
Ac
Rs
RtB
RsB
Ac
Rs
Rs
RsB
Rs
RsB
Rs
AsB
Rs
RsB
Sc
Rs
Rt
Ku
Rs
Rs
Ku
Rs
AsB
Ac
Sc
Rs
Rt
Rt
Rs
Gh
Rs
AsC
Rs
RtD2
Rt
RsB
RtB
Ku
RtD2
Cb
Ku
RsB
Ac
RtB
RtD2
RtD2
RtD2
Rs
Cb
RtD2
OaF
RtD2
Rt
AsC
Rs
KuC
RtC
Cb
OaF
Cb
Rs
OaF
RtD2
Cb
Cb
OaF
Rs
RtB
RtD2
OaF
WpB
AsB
Cb
OaF
RtB
AsC
Ku
AsB
HdB
RsB
OaF
Cb
Rs
Ku
AsB
HdB
RsB
OaF
Rs
RtB
AsC
HdB
AsB
WpB
AsB
HdB
Cb
Rs
HaB
AsB
AsC
VaF
WpB
OaF
AsB
VcD
OaF
HaB
VcD
AsB
WpB
Sc
Cb
Cb
OaF
HaB
AsB
VcD
VcD
HdB
AsB
AsB
VcB
VaF
VaF
VaF
HdB
VcD
AsC
VaF
VcD
VaF

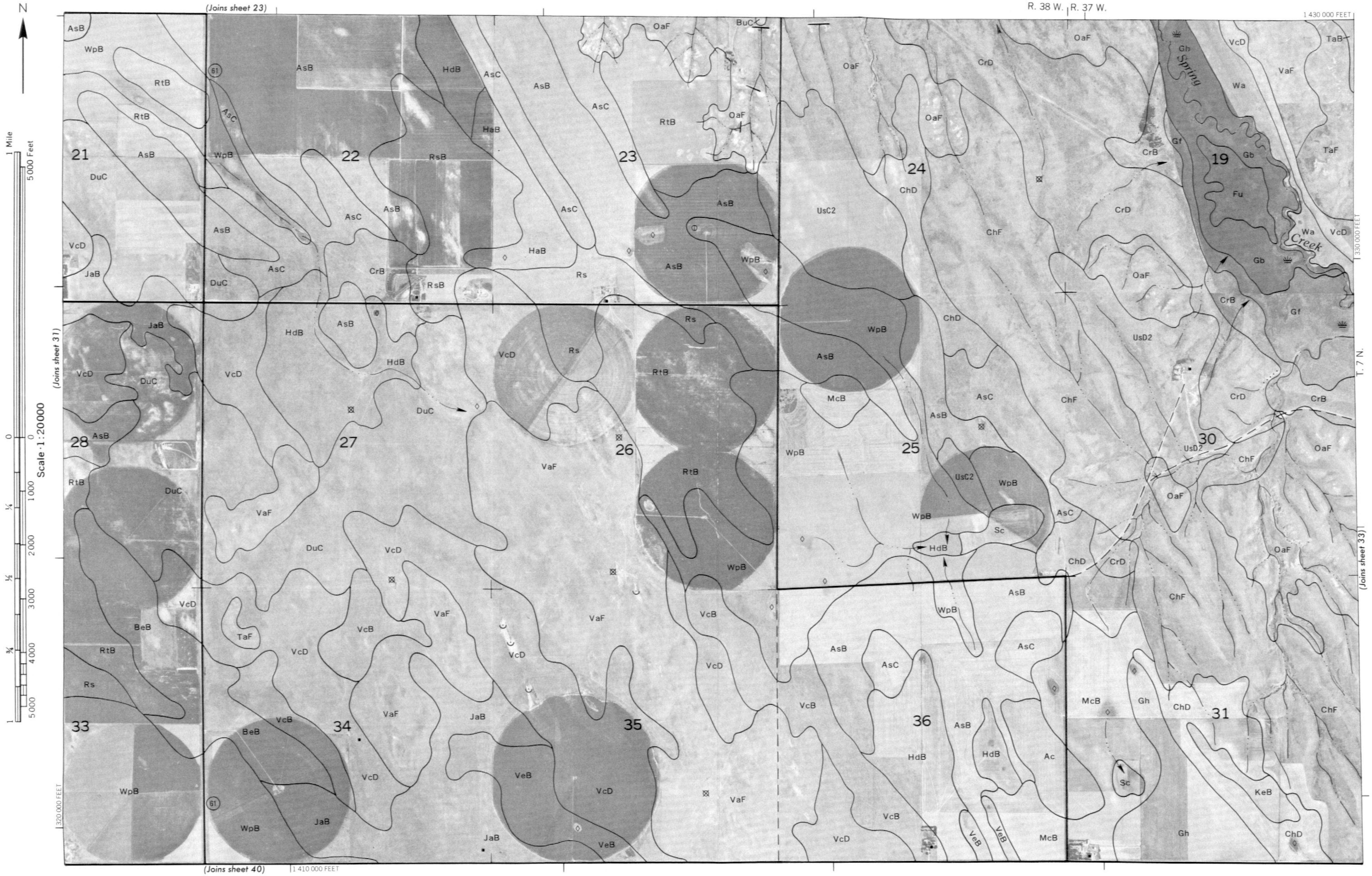

28
N
(Joins sheet 19)
(Joins sheet 27)
(Joins sheet 29)
(Joins sheet 36)
R. 41 W.
R. 40 W.
T. 7 N.
1 335 000 FEET
325 000 FEET
1 315 000 FEET
1 Mile
5000 Feet
Scale 1:20000
Top Flight Landing Strip
Frenchman Creek
Waln Slough
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31

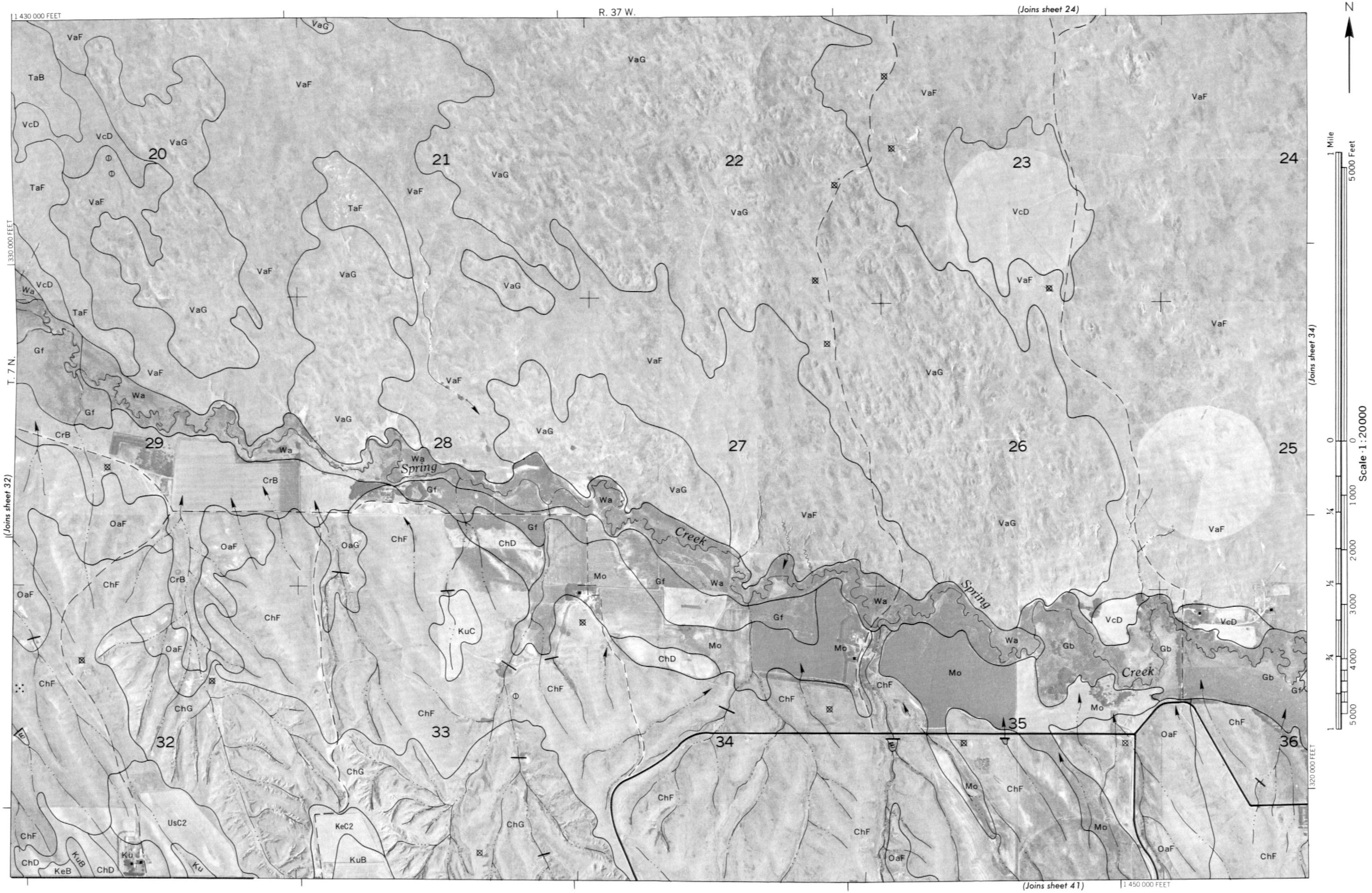
29

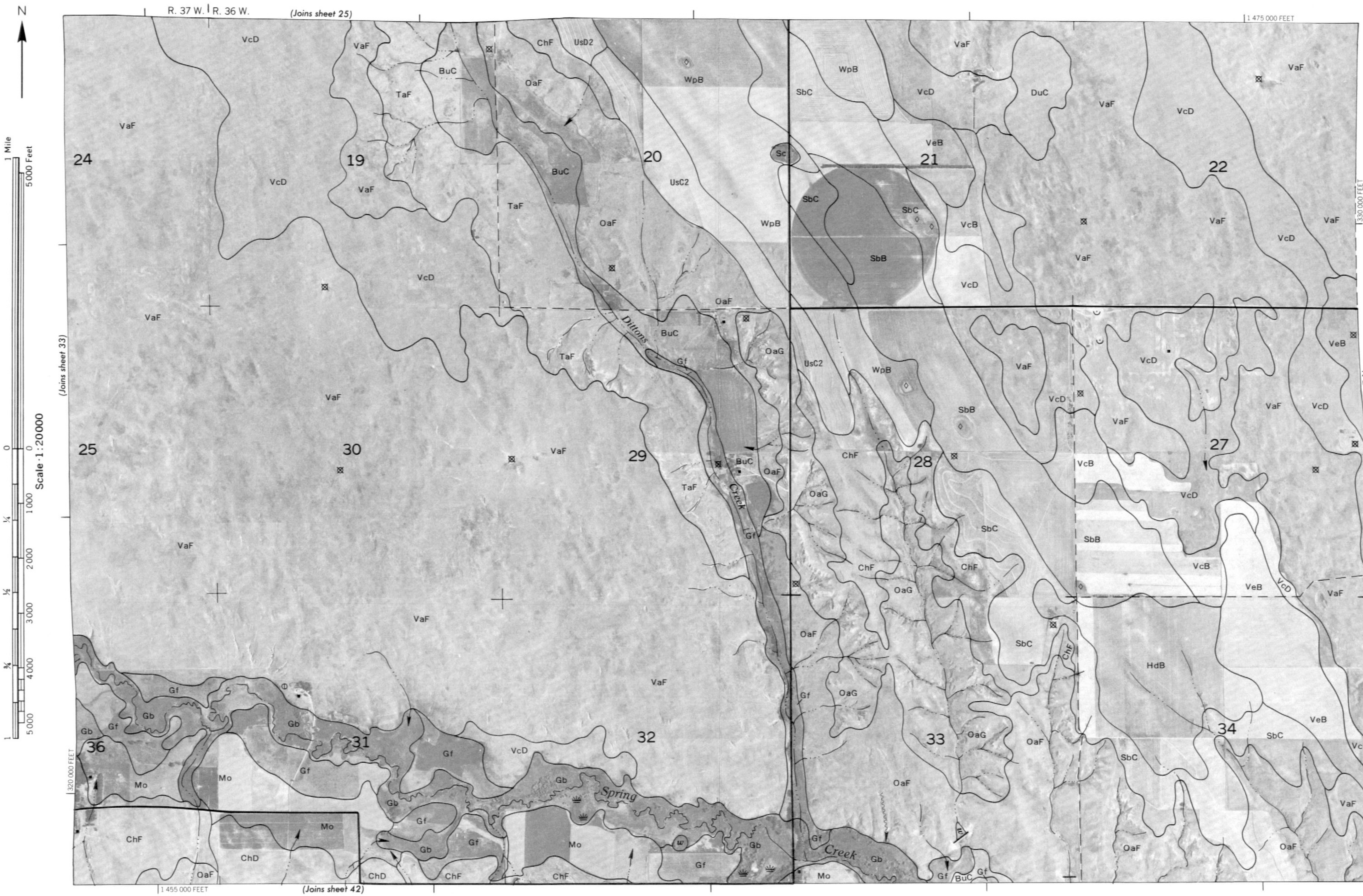

R. 40 W.
T. 7 N.
(Joins sheet 20)
(Joins sheet 30)
(Joins sheet 28)
(Joins sheet 37)
1 335 000 FEET
335 000 FEET
325 000 FEET
1 355 000 FEET
20
21
22
23
24
29
28
27
26
25
32
33
34
35
36
Davidson Branch
N
1 Mile
5000 Feet
Scale 1:20000

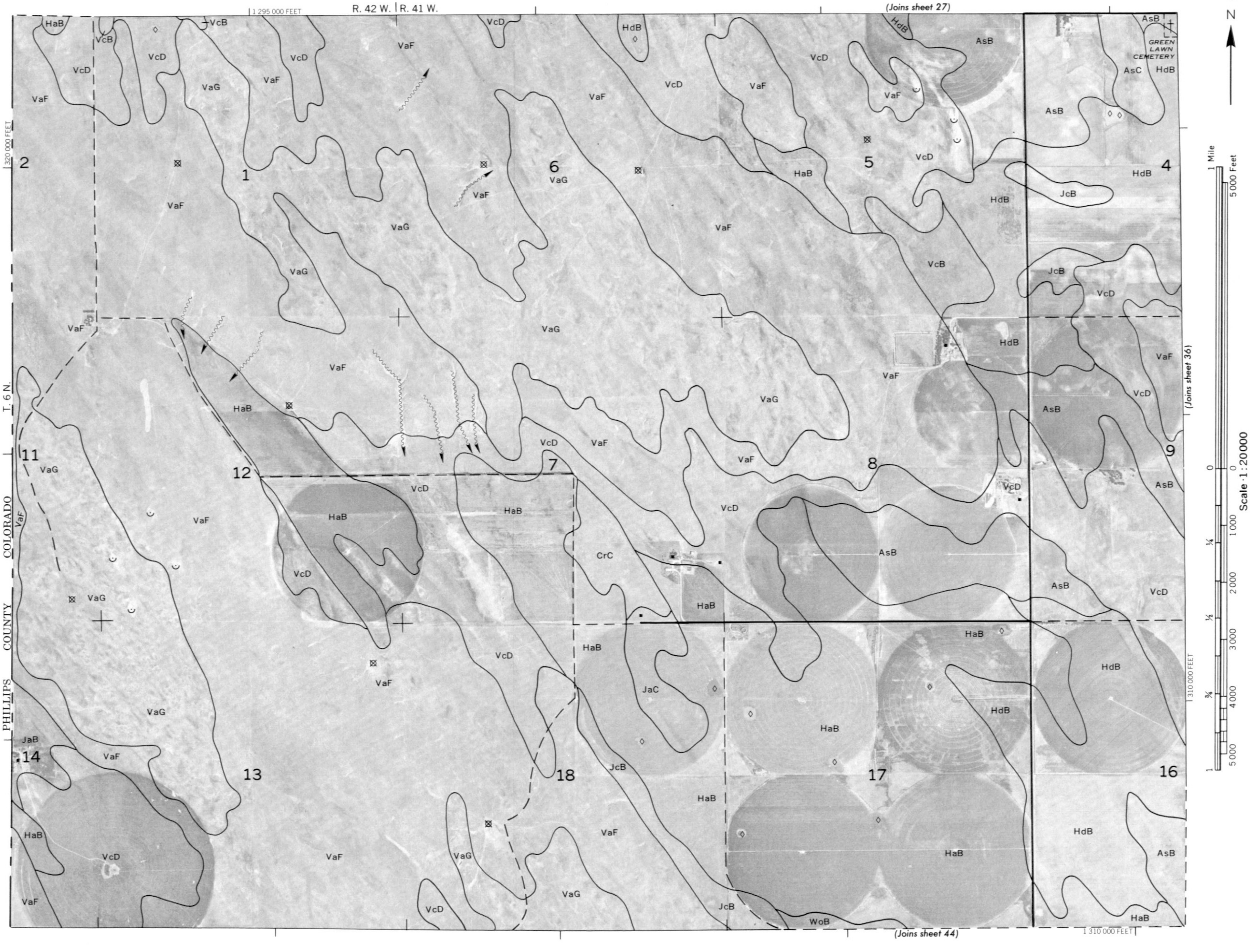

N
R. 40 W.
R. 39 W.
(Joins sheet 21)
(Joins sheet 29)
(Joins sheet 31)
(Joins sheet 38)
T. 7 N.
1 380 000 FEET
335 000 FEET
325 000 FEET
1 360 000 FEET
CHASE CEMETERY
Sand Draw
Scale 1:20000
1 Mile
5000 Feet
24
19
20
21
22
25
30
29
28
27
36
31
32
33
34


31
N
R. 39 W.
R. 38 W.
1 385 000 FEET
335 000 FEET
(Joins sheet 22)
(Joins sheet 32)
(Joins sheet 30)
(Joins sheet 39)
T. 7 N.
1 405 000 FEET
320 000 FEET
Scale 1:20000
1 Mile
5000 Feet
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
WANAMAKER
STATE SPECIAL
USE
AREA
MOUNT HOPE CEMETERY
IMPERIAL
(county seat)
VcD
WpB
TaB
VaF
JcB
VeB
HaB
AsB
RtB
JaB
RtC
BeB
VcB
DuC
Rs
JaC
WoB
Ac
Gh
AsB
VaF
6

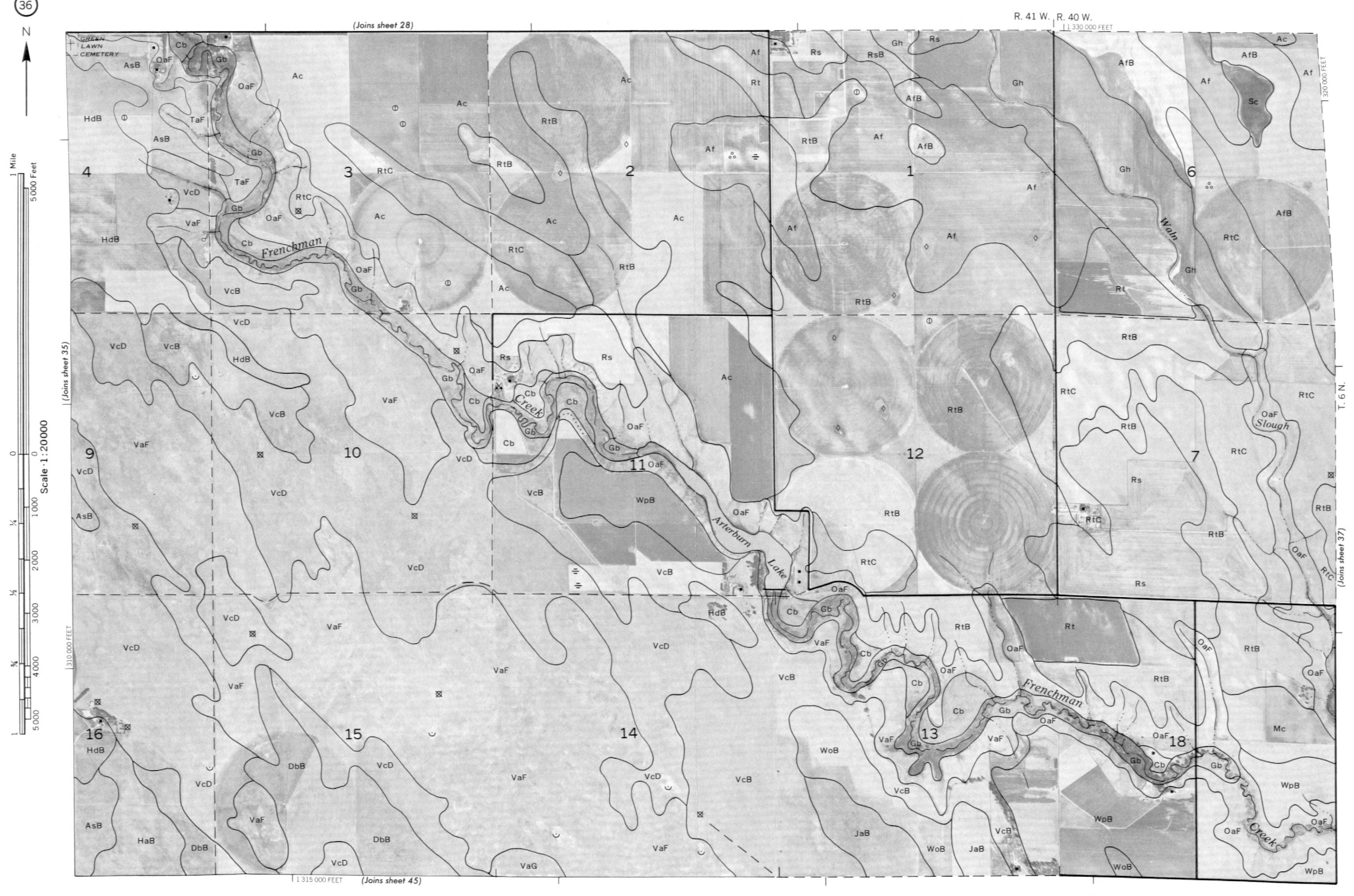

N
1 Mile
5000 Feet
0
1/4
1/2
3/4
1
Scale 1:20 000
0
1000
2000
3000
4000
5000
(Joins sheet 23)
(Joins sheet 31)
(Joins sheet 33)
(Joins sheet 40)
R. 38 W. R. 37 W.
T. 7 N.
1 430 000 FEET
330 000 FEET
320 000 FEET
1 410 000 FEET
Spring
Creek
61
19
21
22
23
24
25
26
27
28
30
31
33
34
35
36
AsB
WpB
RtB
DuC
VcD
JaB
AsC
HdB
HaB
RsB
CrB
OaF
BuC
Rs
UsC2
ChD
ChF
CrD
Gb
Gf
Fu
Wa
TaB
VaF
McB
Sc
UsD2
VcB
TaF
BeB
VeB
Gh
KeB
Ac

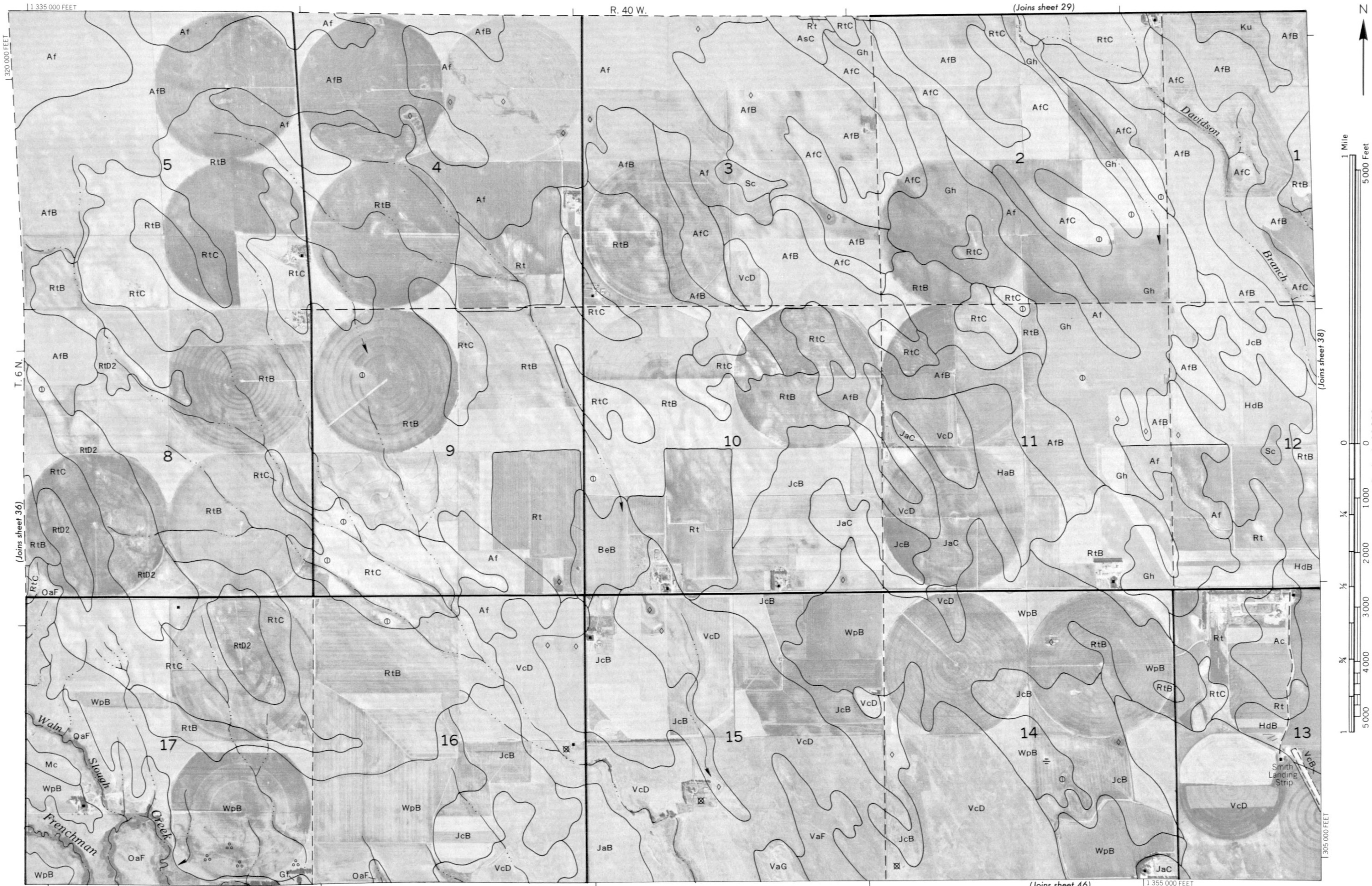

33
N
1 430 000 FEET
R. 37 W.
(Joins sheet 24)
330 000 FEET
T. 7 N.
(Joins sheet 32)
(Joins sheet 34)
(Joins sheet 41)
1 450 000 FEET
320 000 FEET
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
Spring
Creek
Spring
Creek
VaF
VaG
TaB
VcD
TaF
Wa
Gf
CrB
OaF
OaG
ChF
ChD
ChG
KuC
Mo
Gb
UsC2
KeC2
KuB
KeB
Ku

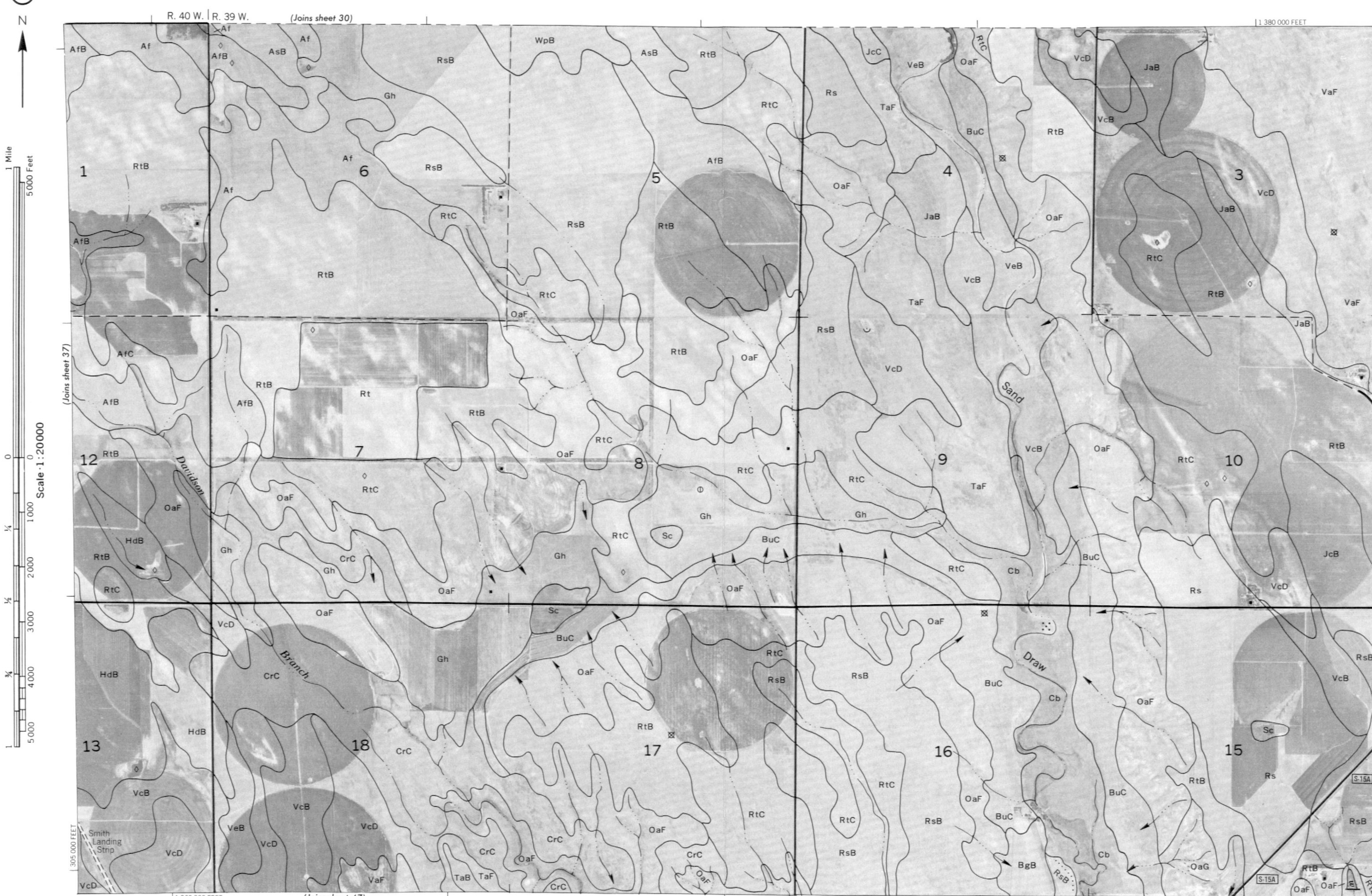

N
1 Mile
5000 Feet
0
Scale 1:20000
1000
2000
3000
4000
5000
R. 37 W.
R. 36 W.
(Joins sheet 25)
1 475 000 FEET
(Joins sheet 33)
330 000 FEET
T. 7 N.
(Joins inset, sheet 26)
320 000 FEET
1 455 000 FEET
(Joins sheet 42)
24
19
20
21
22
25
30
29
28
27
36
31
32
33
34
Dittons
Creek
Spring
Creek
VcD
VaF
BuC
ChF
UsD2
OaF
TaF
WpB
SbC
DuC
VeB
Sc
UsC2
SbB
VcB
Gf
OaG
HdB
Gb
Mo
ChD



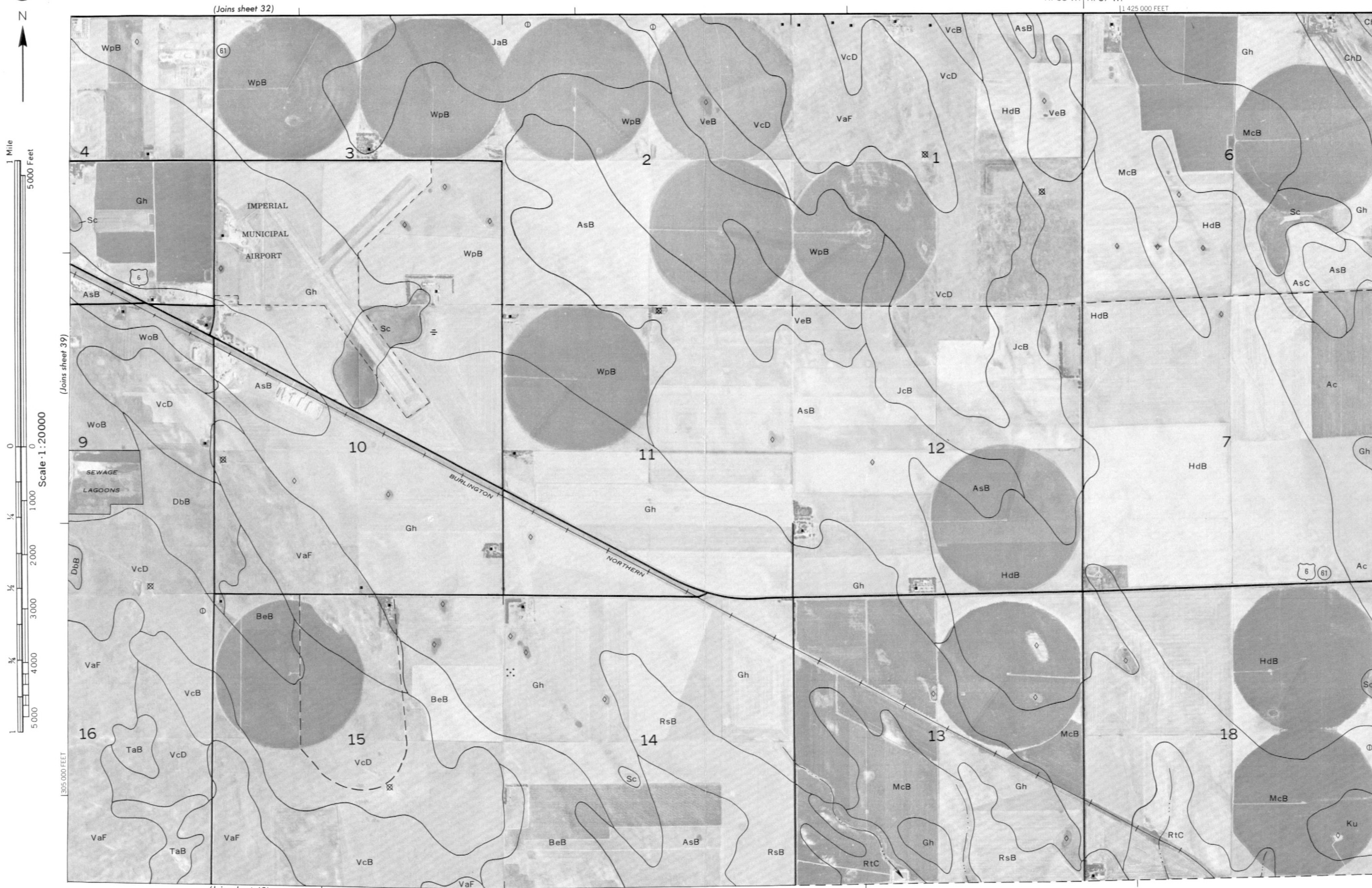
(Joins sheet 27)
(Joins sheet 36)
(Joins sheet 44)
R. 42 W. | R. 41 W.
T. 6 N.
1 295 000 FEET
320 000 FEET
310 000 FEET
1 310 000 FEET
COLORADO
PHILLIPS COUNTY
GREEN LAWN CEMETERY
N
Scale 1:20 000
1 Mile
5 000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000
HaB
VcB
VcD
VaF
VaG
HdB
AsB
AsC
JcB
CrC
JaC
JaB
WoB
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18


36
N
(Joins sheet 28)
(Joins sheet 35)
(Joins sheet 37)
(Joins sheet 45)
R. 41 W.
R. 40 W.
1 330 000 FEET
320 000 FEET
310 000 FEET
1 315 000 FEET
T. 6 N.
GREEN LAWN CEMETERY
Frenchman Creek
Arterburn Lake
Waln Slough
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
¼
½
¾
1
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18

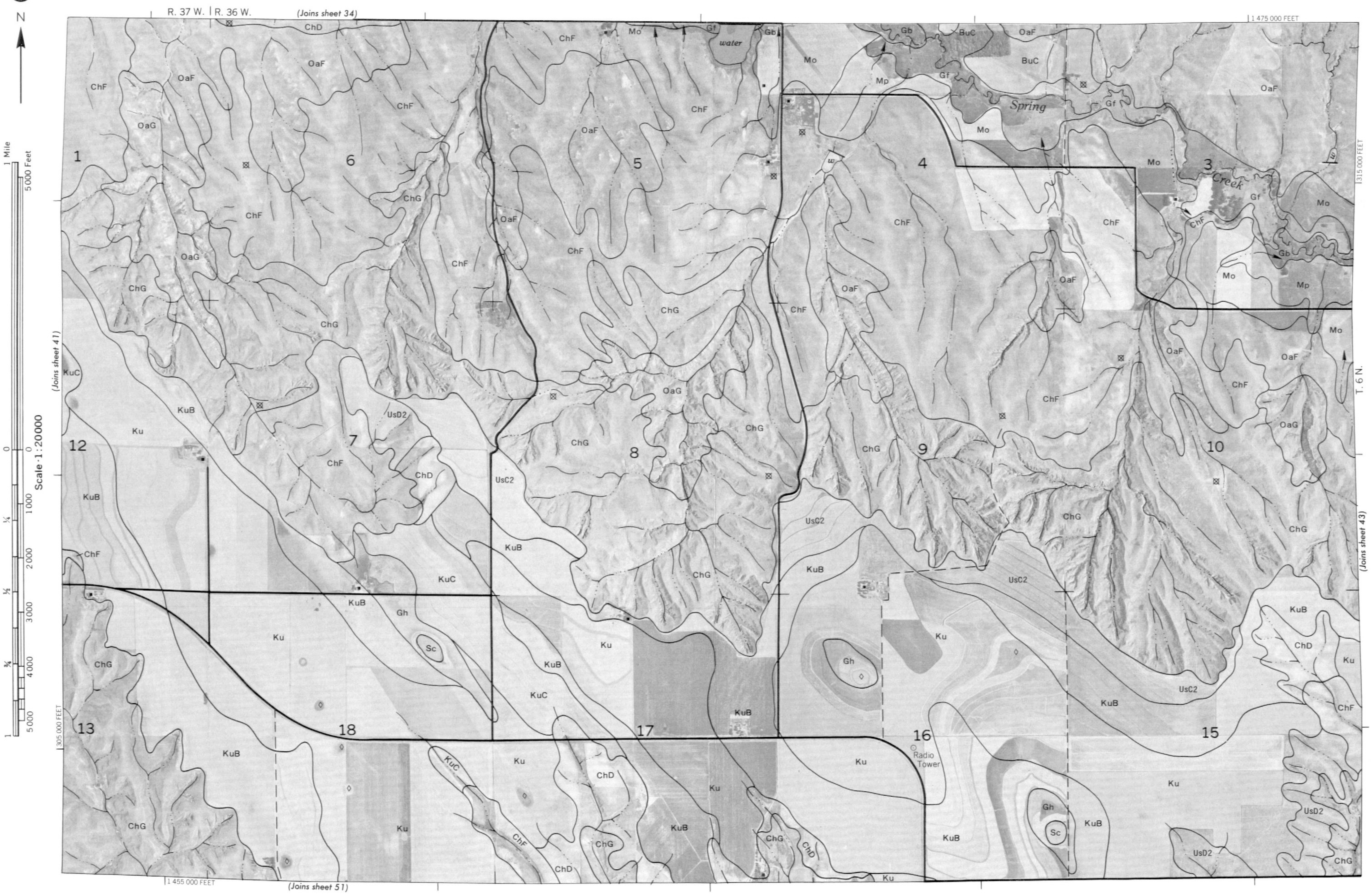

1 335 000 FEET
320 000 FEET
R. 40 W.
(Joins sheet 29)
T. 6 N.
(Joins sheet 36)
(Joins sheet 38)
(Joins sheet 46)
1 355 000 FEET
305 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000
Davidson
Branch
Waln
Slough
Frenchman
Creek
Smith
Landing
Strip
5
4
3
2
1
8
9
10
11
12
17
16
15
14
13

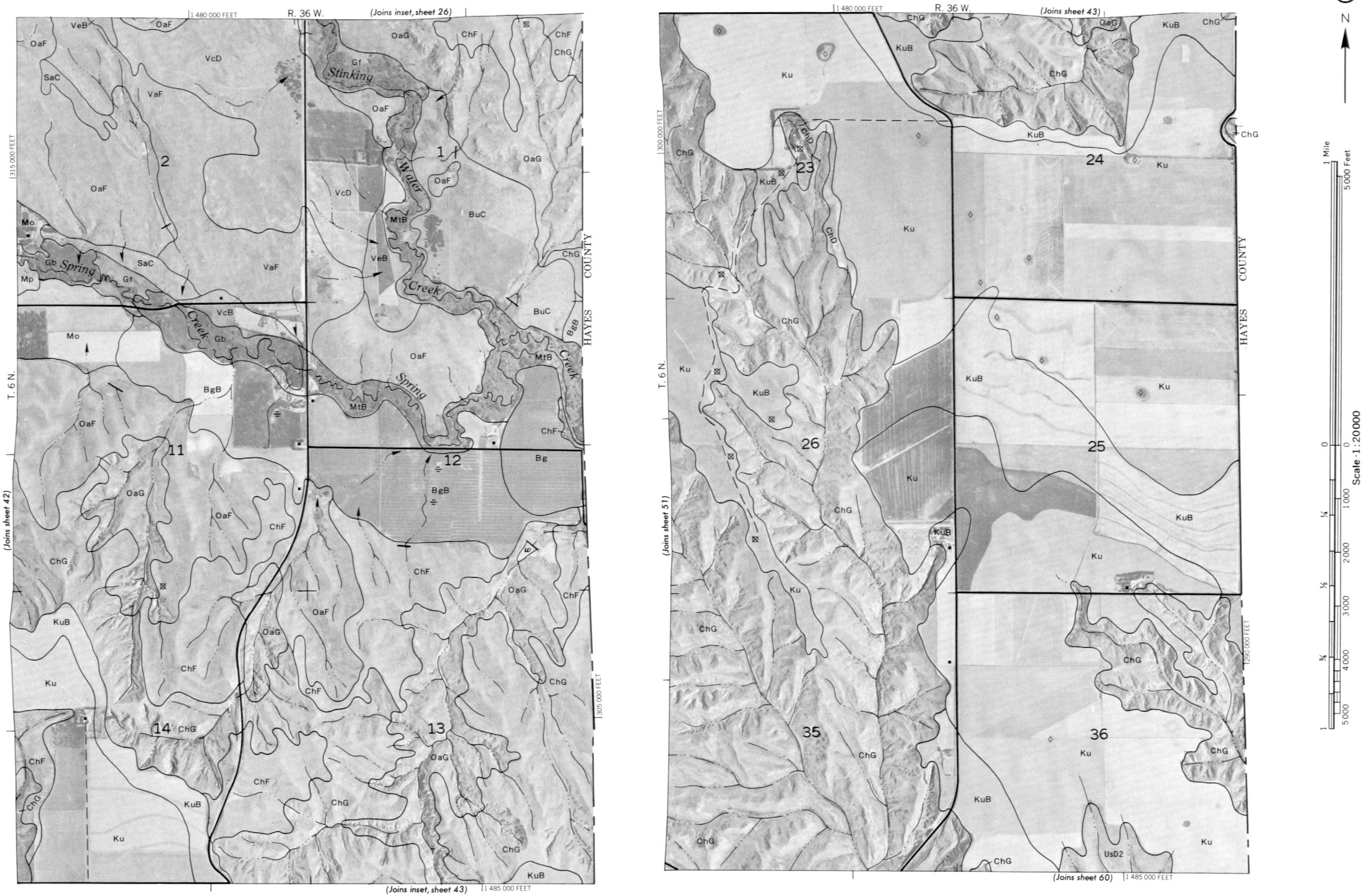

38
N
R. 40 W.
R. 39 W.
(Joins sheet 30)
(Joins sheet 37)
(Joins sheet 39)
(Joins sheet 47)
1 380 000 FEET
315 000 FEET
305 000 FEET
1 360 000 FEET
T. 6 N.
Davidson
Branch
Sand
Draw
Smith
Landing
Strip
S-15A
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
1
3
4
5
6
7
8
9
10
12
13
15
16
17
18

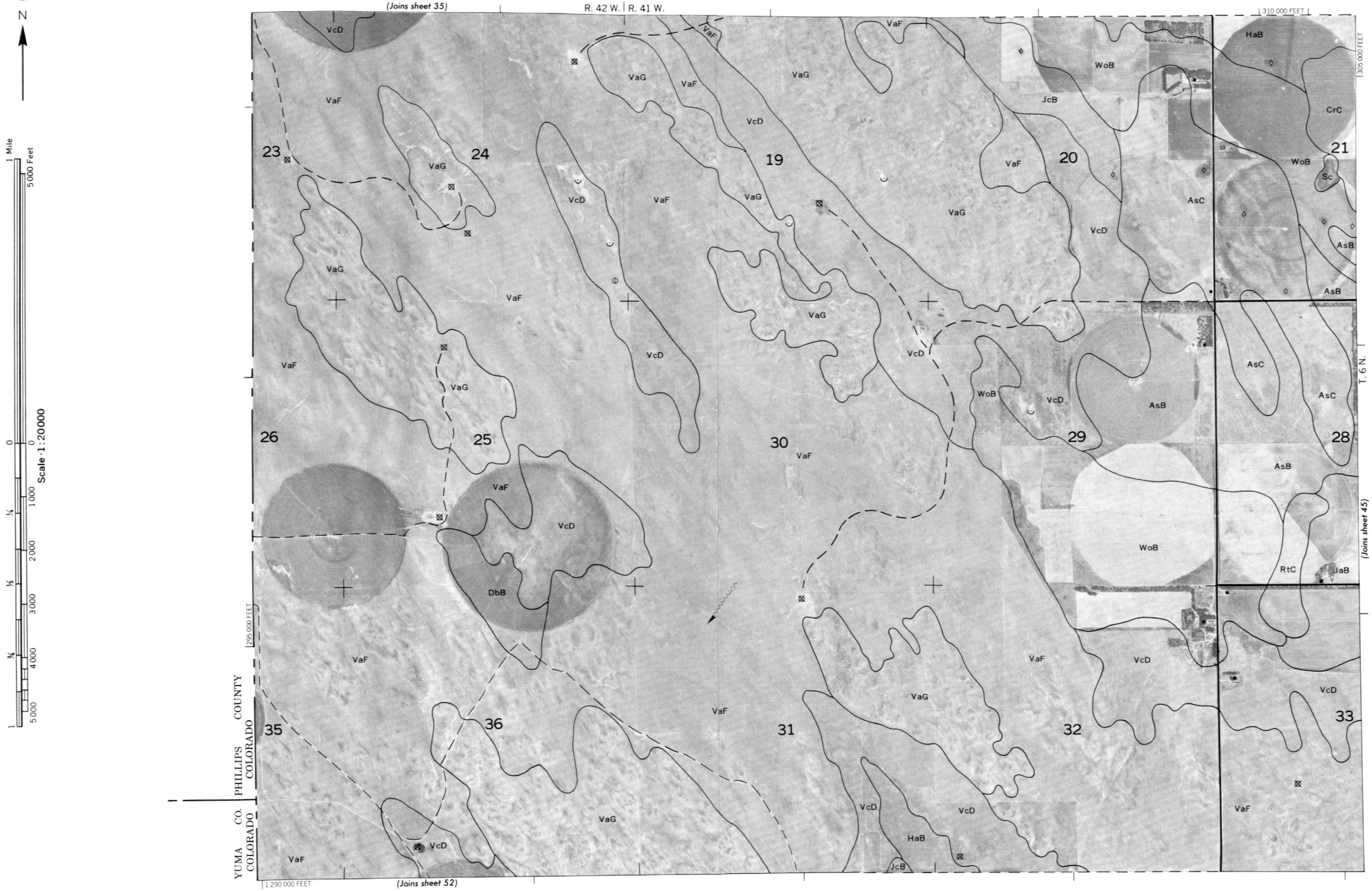
R. 39 W.
R. 38 W.
(Joins sheet 31)
1 385 000 FEET
315 000 FEET
T. 6 N.
(Joins sheet 38)
(Joins sheet 40)
(Joins sheet 48)
1 405 000 FEET
305 000 FEET
N
IMPERIAL
(county seat)
BURLINGTON
NORTHERN
Substation
SANITARY
LANDFILL
SEWAGE
LAGOONS
S-15A
1 Mile
5000 Feet
Scale 1:20000
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18
VaF
VcD
WpB
JaB
HaB
WoB
TaB
VeB
VcB
RtB
JcB
RsB
OaF
AsB
Gh
Sc
DbB
BeB
JaC

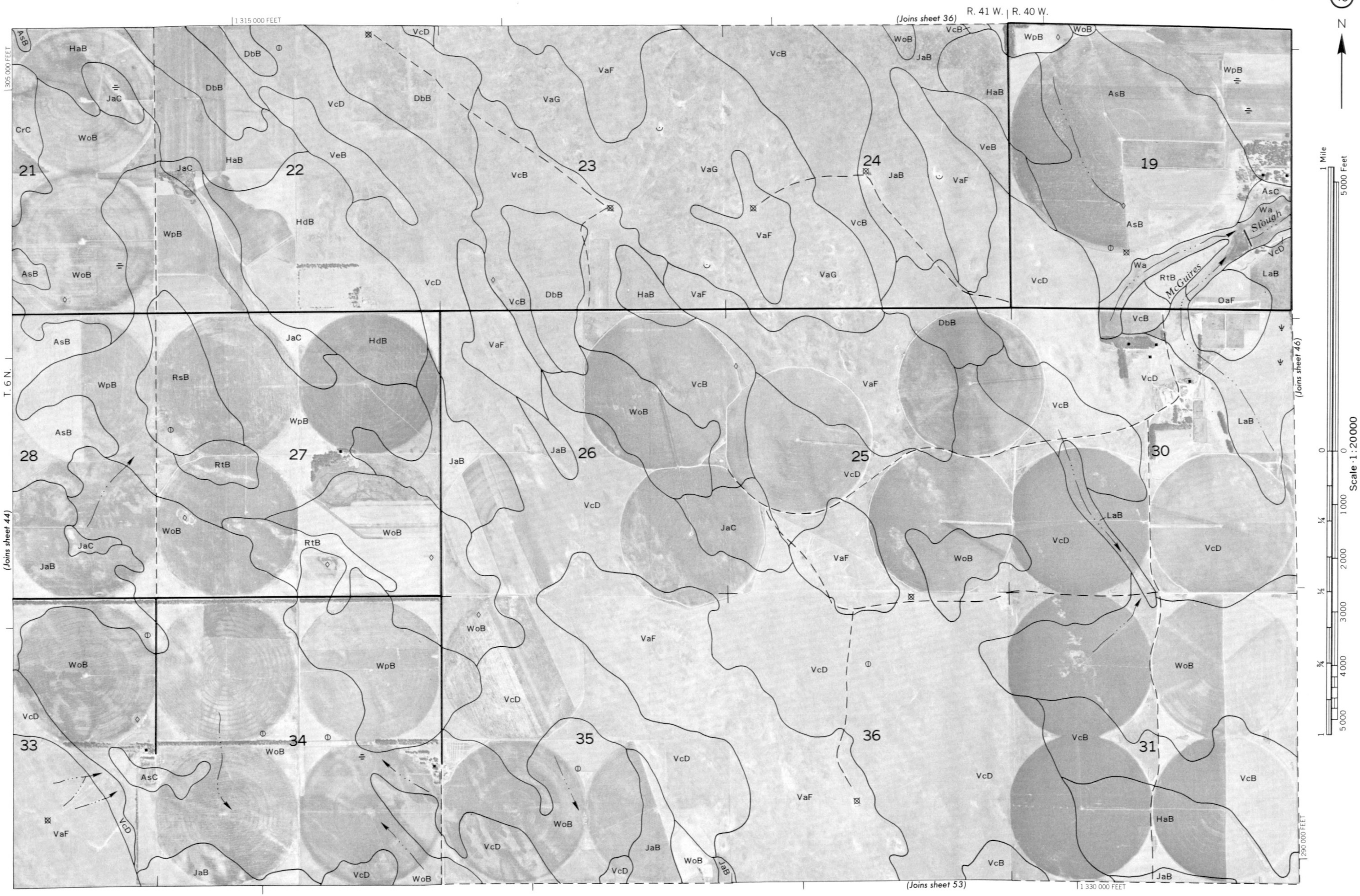

(Joins sheet 32)
(Joins sheet 39)
(Joins sheet 41)
(Joins sheet 49)
R. 38 W.
R. 37 W.
T. 6 N.
1 425 000 FEET
315 000 FEET
305 000 FEET
1 410 000 FEET
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
IMPERIAL
MUNICIPAL
AIRPORT
SEWAGE
LAGOONS
BURLINGTON
NORTHERN
6
61
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18
WpB
JaB
VcB
AsB
ChF
ChD
VcD
VeB
VaF
HdB
Gh
McB
Sc
AsC
WoB
JcB
Ac
DbB
BeB
TaB
RsB
RtC
Ku

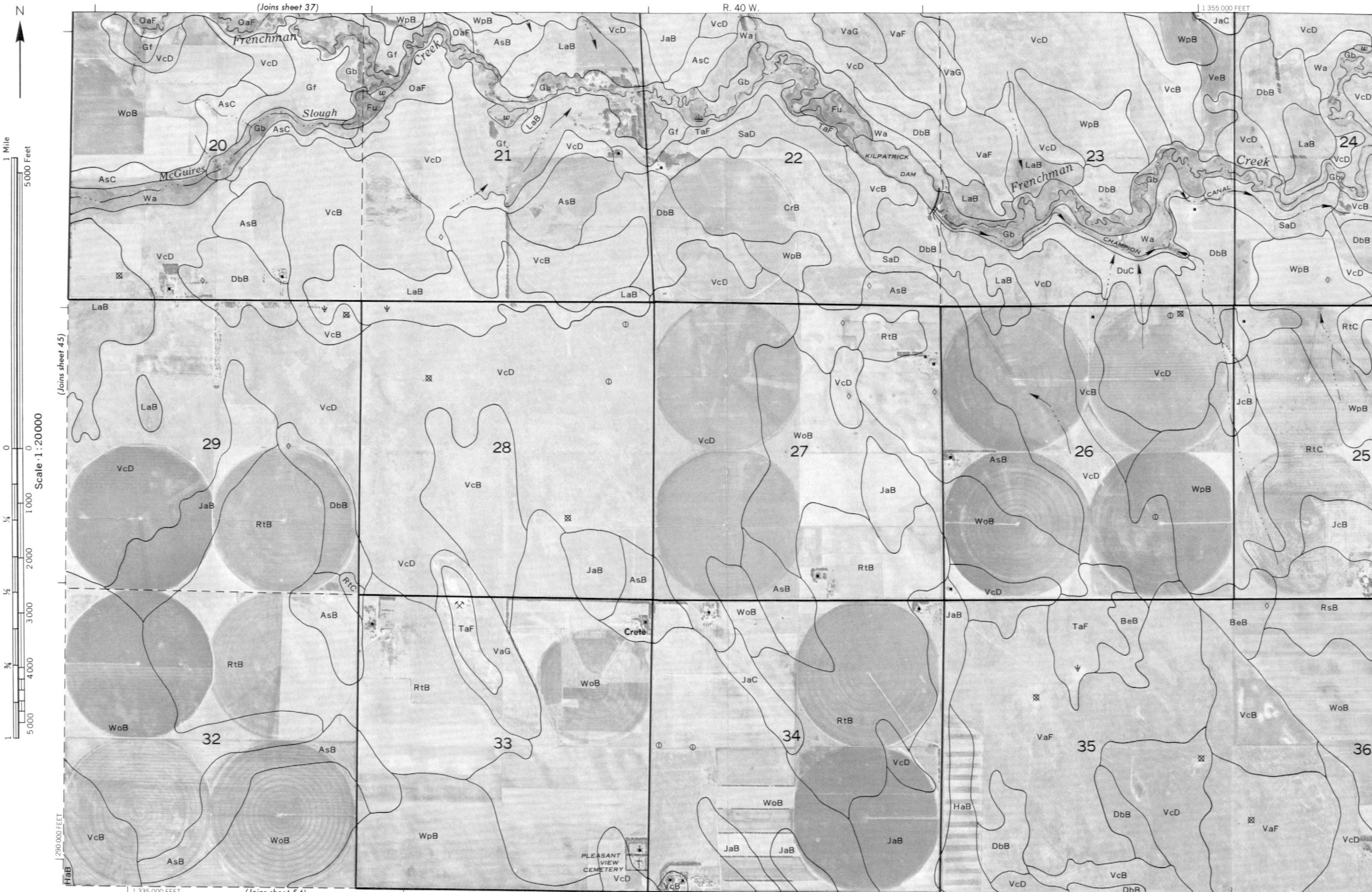

41
N
R. 37 W.
T. 6 N.
(Joins sheet 33)
(Joins sheet 42)
(Joins sheet 50)
(Joins sheet 40)
1 430 000 FEET
1 450 000 FEET
315 000 FEET
305 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1000
2000
3000
4000
5000
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
Smith Landing Strip
6
61
KeB
ChD
ChG
KeC2
KuB
UsC2
Ku
ChF
OaF
Mo
KuC
AsC
Gh
CrD
AsB
Ac
Sc
UsD2
JaC
SaD
RsB
HdB
McB
CrC
RtC
CrB

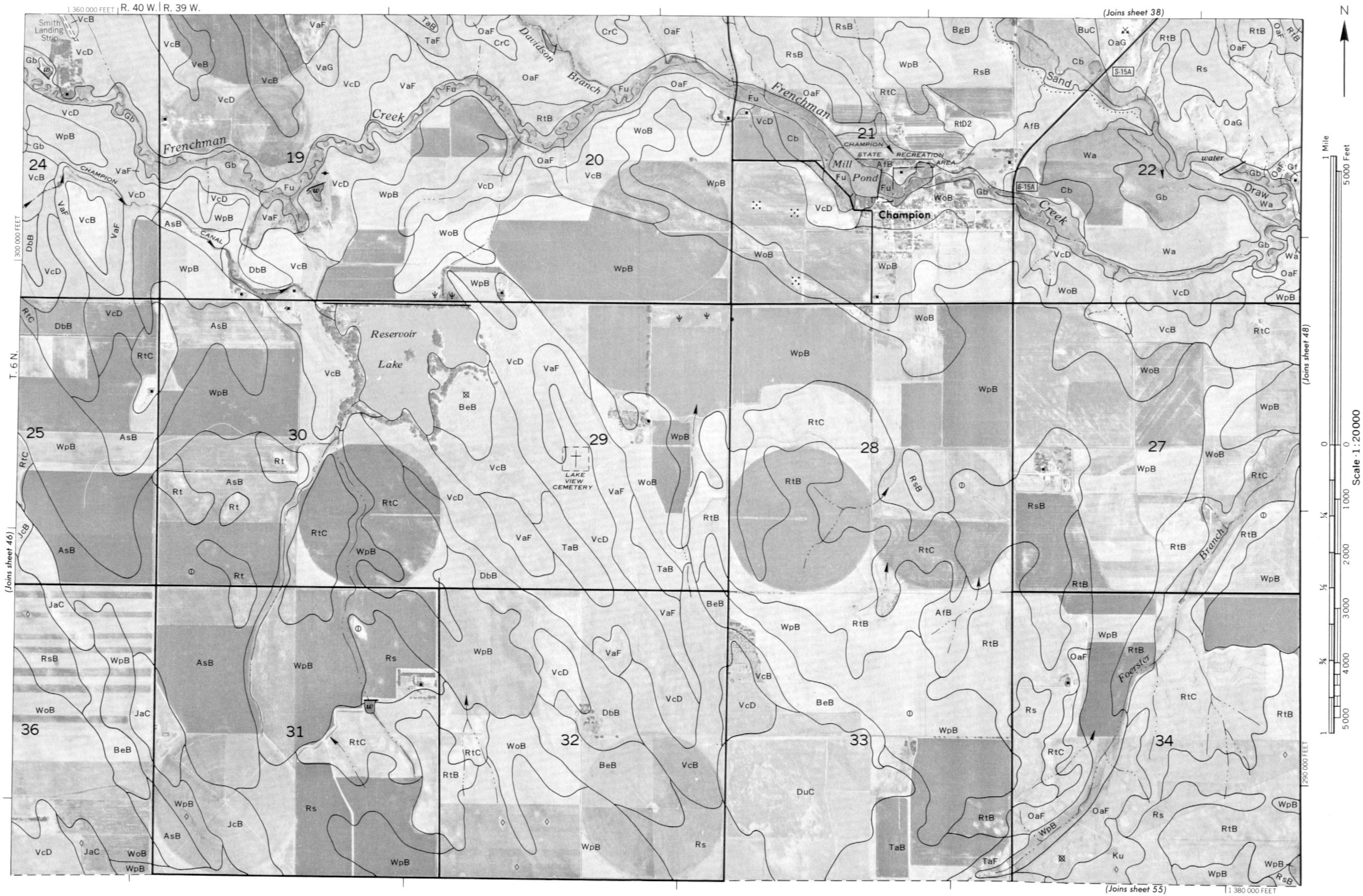

N
R. 37 W.
R. 36 W.
(Joins sheet 34)
(Joins sheet 41)
(Joins sheet 43)
(Joins sheet 51)
T. 6 N.
1 475 000 FEET
315 000 FEET
305 000 FEET
1 455 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
1
2
3
4
5
6
7
8
9
10
12
13
15
16
17
18
Spring
Creek
water
Radio Tower
ChD
ChF
ChG
OaF
OaG
Mo
Mp
Gf
Gb
BuC
KuB
KuC
Ku
UsC2
UsD2
Gh
Sc
w

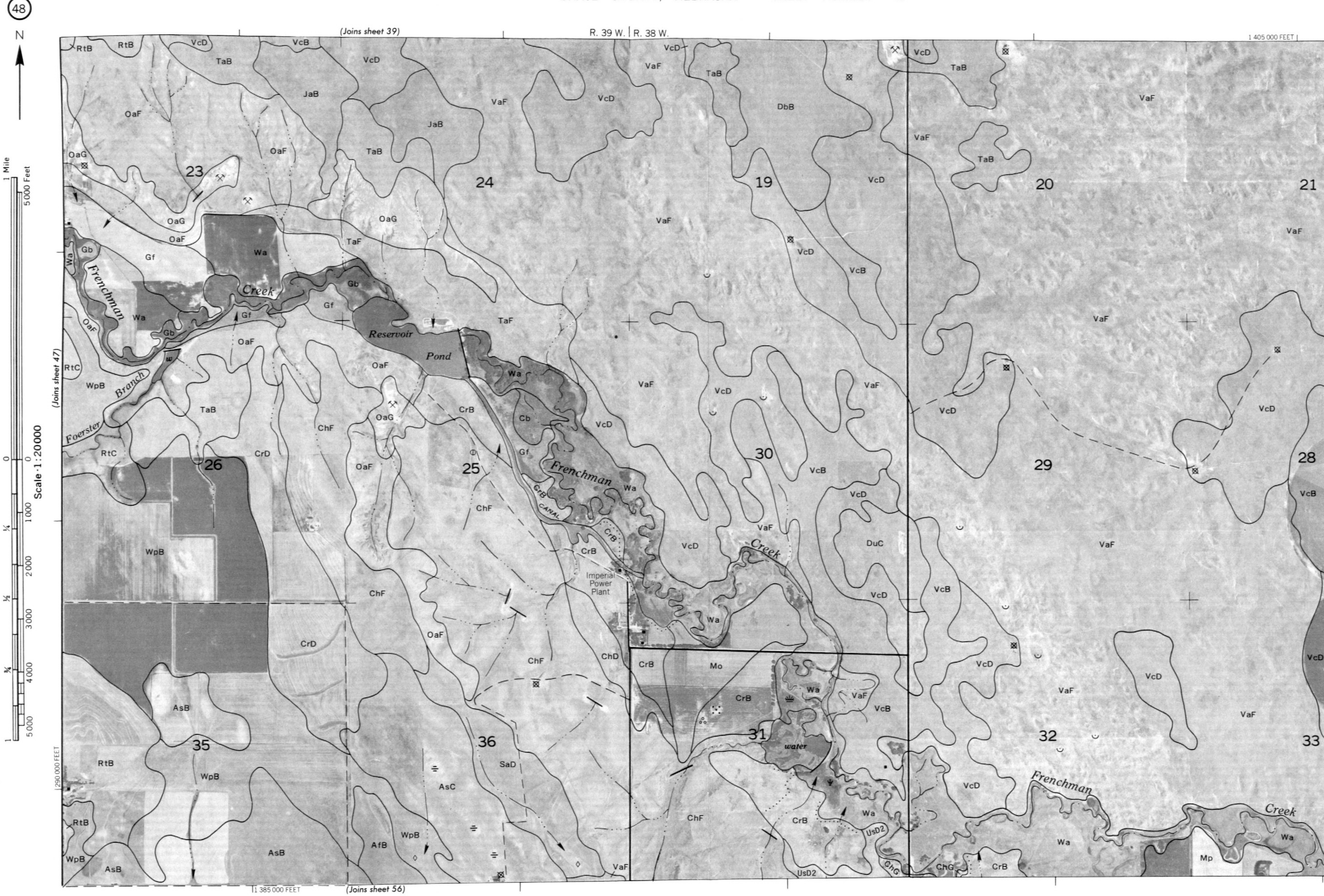

43
N
1 480 000 FEET
R. 36 W.
(Joins inset, sheet 26)
(Joins sheet 43)
315 000 FEET
300 000 FEET
290 000 FEET
305 000 FEET
T. 6 N.
(Joins sheet 42)
(Joins sheet 51)
(Joins inset, sheet 43)
(Joins sheet 60)
1 485 000 FEET
HAYES COUNTY
Stinking Water Creek
Spring Creek
VeB
OaF
OaG
ChF
ChG
SaC
VaF
VcD
Gf
Gb
Mo
Mp
BuC
MtB
VcB
BgB
BgB
Bg
KuB
Ku
ChD
UsD2
1
2
11
12
13
14
23
24
25
26
35
36
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1

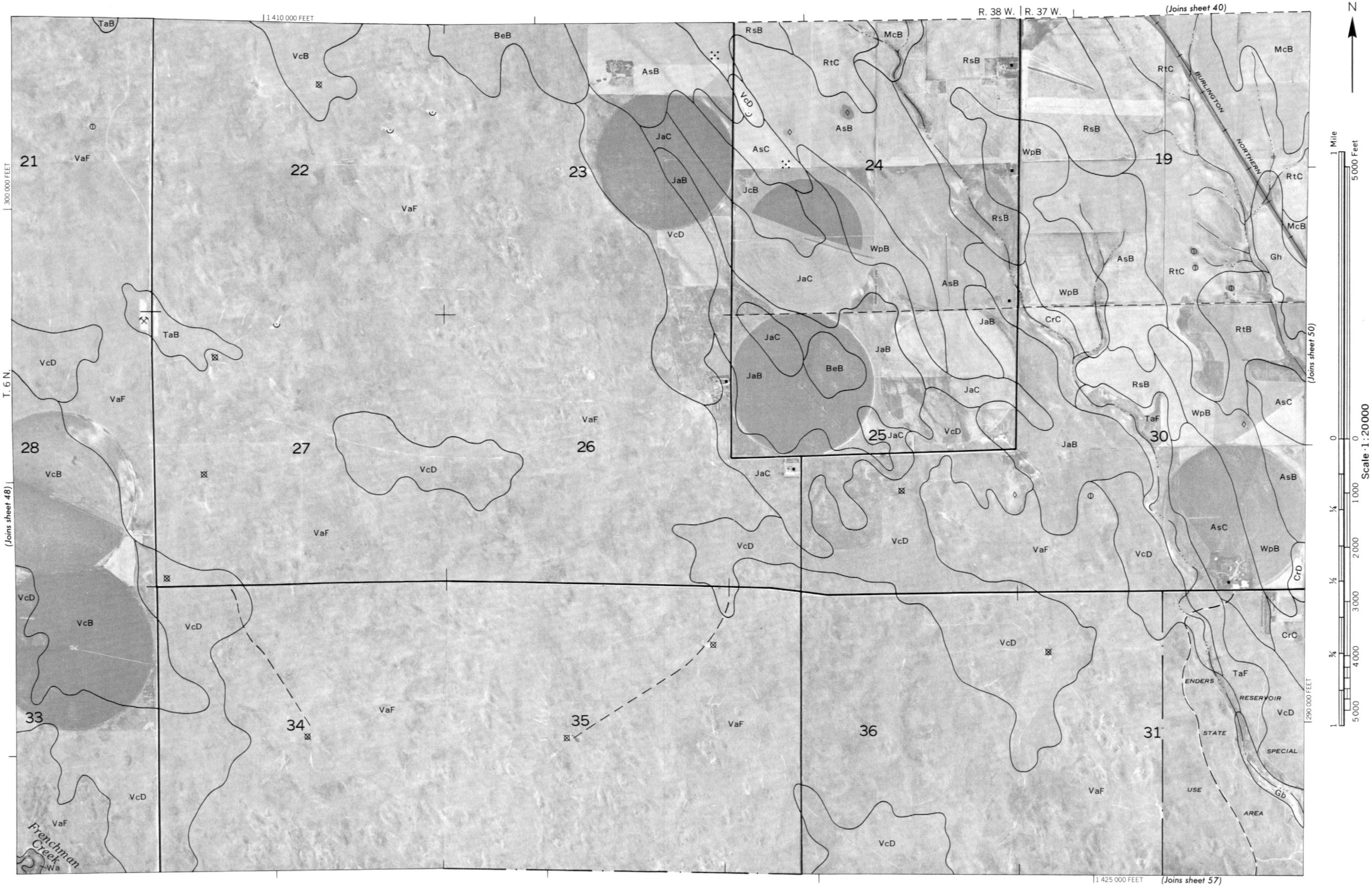

N
1 Mile
5000 Feet
0
0
Scale 1:20000
1000
¼
2000
½
3000
¾
4000
5000
1
(Joins sheet 35)
R. 42 W.
R. 41 W.
1 310 000 FEET
305 000 FEET
T. 6 N.
(Joins sheet 45)
295 000 FEET
1 290 000 FEET
(Joins sheet 52)
PHILLIPS COUNTY
COLORADO
YUMA CO.
COLORADO
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
VcD
VaF
VaG
HaB
WoB
JcB
CrC
Sc
AsC
AsB
DbB
RtC
JaB

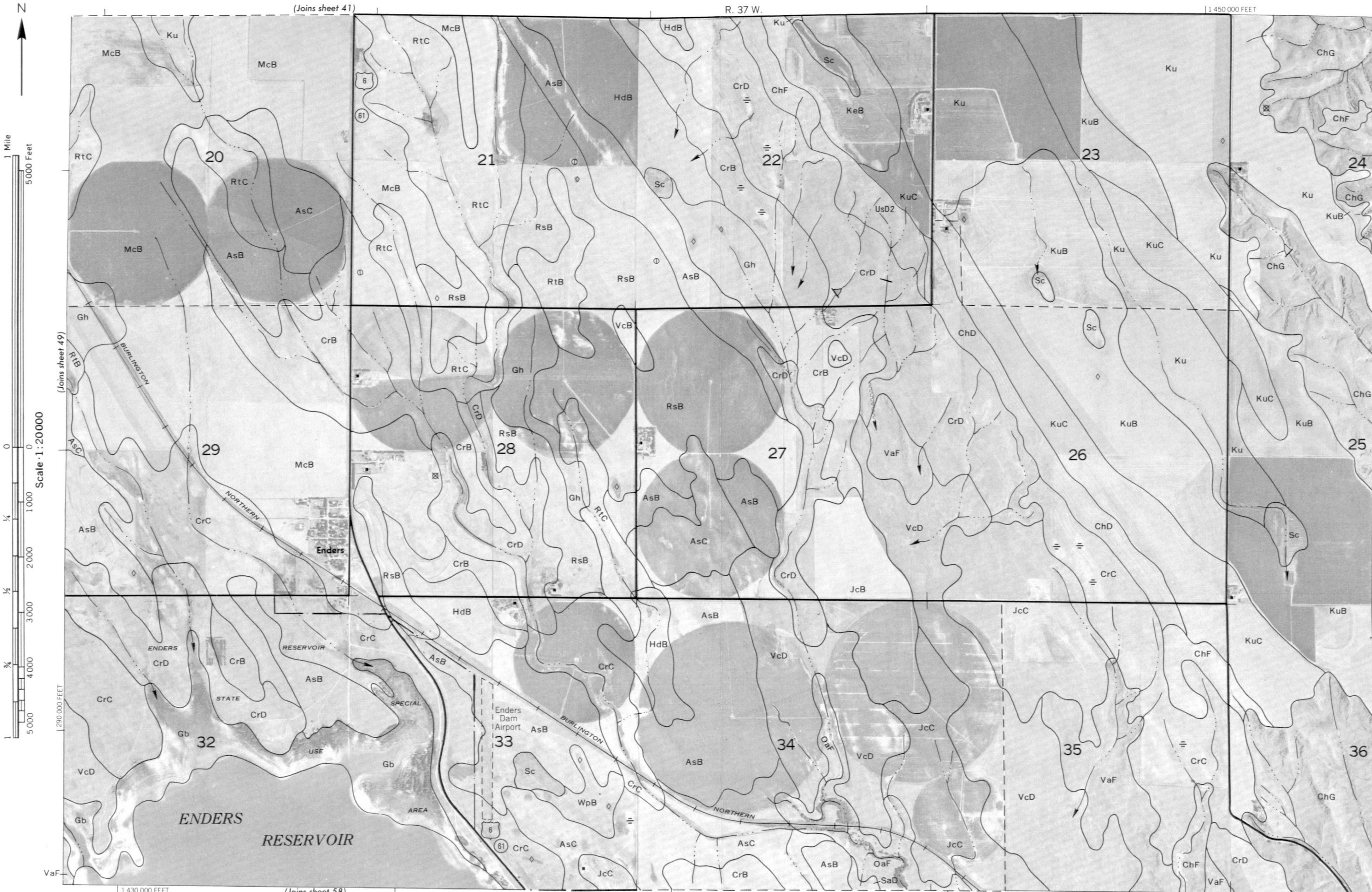

45
N
(Joins sheet 36)
R. 41 W.
R. 40 W.
1 315 000 FEET
305 000 FEET
T. 6 N.
(Joins sheet 44)
(Joins sheet 46)
(Joins sheet 53)
1 330 000 FEET
290 000 FEET
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31
McGuires
Slough
AsB
HaB
JaC
CrC
WoB
DbB
VcD
VeB
HaB
JaC
WpB
HdB
VaF
VaG
VcB
JaB
WpB
AsC
Wa
RtB
LaB
OaF
RsB
JaC
VcD
DbB
VaF
JaC
LaB
VaF
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1

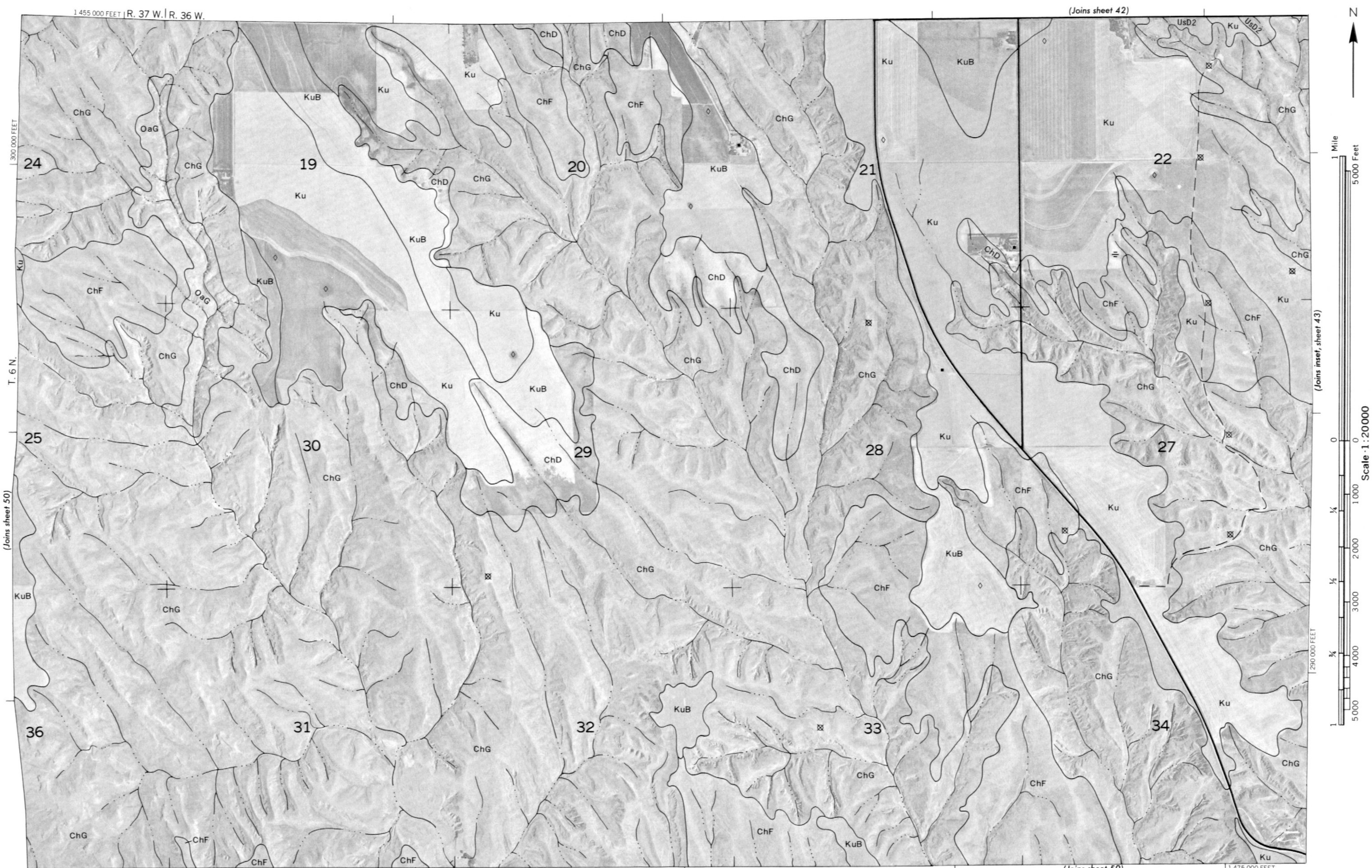

N
1 Mile
5000 Feet
0
Scale 1:20000
(Joins sheet 37)
(Joins sheet 45)
(Joins sheet 47)
(Joins sheet 54)
R. 40 W.
T. 6 N.
1 355 000 FEET
300 000 FEET
290 000 FEET
1 335 000 FEET
Frenchman Creek
Slough
McGuires
KILPATRICK DAM
CHAMPION CANAL
Crete
PLEASANT VIEW CEMETERY
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36

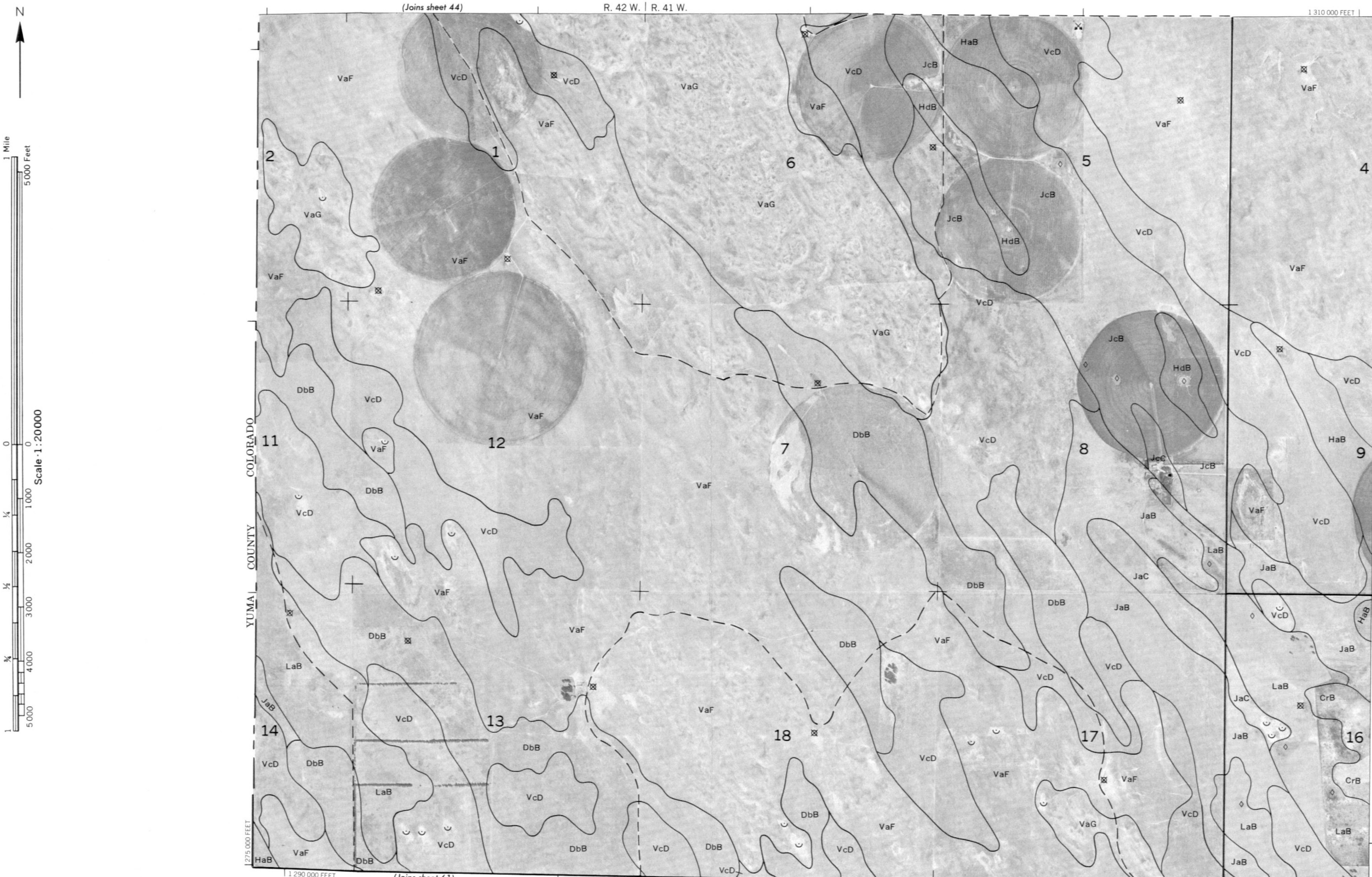

N
(Joins sheet 38)
(Joins sheet 48)
(Joins sheet 55)
(Joins sheet 46)
1 360 000 FEET
1 380 000 FEET
300 000 FEET
290 000 FEET
R. 40 W.
R. 39 W.
T. 6 N.
Smith Landing Strip
Frenchman Creek
Davidson Branch
Champion Canal
Reservoir Lake
Lake View Cemetery
Champion State Recreation Area
Mill Pond
Champion
Sand Creek
water
Draw
Foerster Branch
S-15A
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36
1 Mile
5000 Feet
Scale 1:20 000
0
1000
2000
3000
4000
5000
¼
½
¾
1

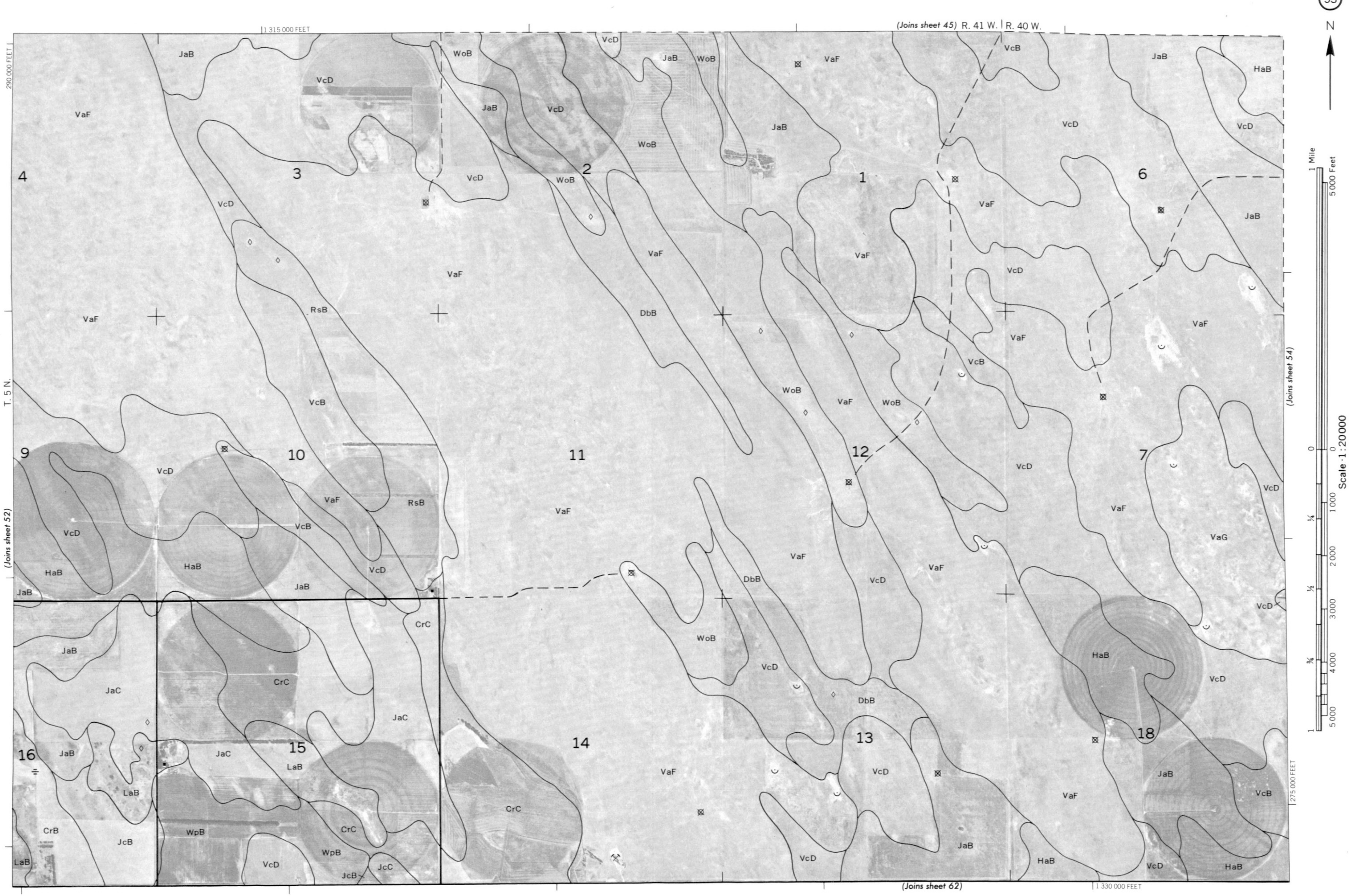

48
N
(Joins sheet 39)
(Joins sheet 47)
(Joins sheet 49)
(Joins sheet 56)
R. 39 W. | R. 38 W.
T. 6 N.
1 405 000 FEET
300 000 FEET
290 000 FEET
1 385 000 FEET
Scale 1:20000
1 Mile
5000 Feet
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
Frenchman Creek
Reservoir Pond
Foerster Branch
CANAL
Imperial Power Plant
water
RtB
VcD
VcB
TaB
JaB
VaF
DbB
OaF
OaG
Gb
Gf
Wa
TaF
RtC
WpB
CrB
CrD
ChF
Cb
ChD
Mo
DuC
AsB
AsC
SaD
AfB
Mp
ChG
UsD2

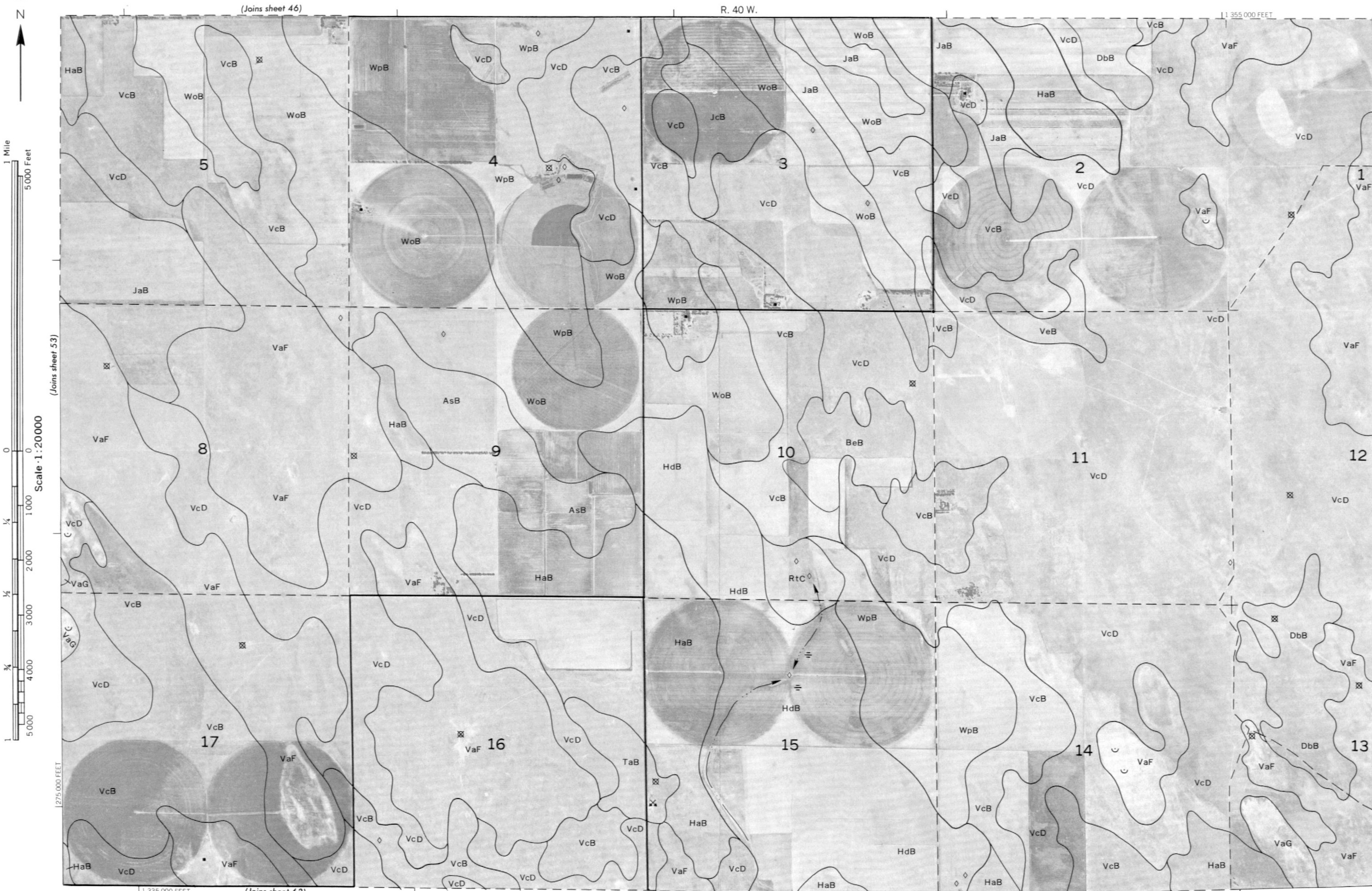

49
N
(Joins sheet 40)
R. 38 W.
R. 37 W.
1 410 000 FEET
300 000 FEET
290 000 FEET
1 425 000 FEET
T. 6 N.
(Joins sheet 48)
(Joins sheet 50)
(Joins sheet 57)
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31
TaB
VcB
BeB
AsB
RsB
McB
RtC
VcD
JaC
JaB
AsC
JcB
WpB
VaF
RtB
CrC
TaF
CrD
Gh
Gb
Wa
BURLINGTON
NORTHERN
ENDERS
RESERVOIR
STATE
SPECIAL
USE
AREA
Frenchman Creek
Scale 1:20000
1 Mile
5000 Feet
0
¼
½
¾
1000
2000
3000
4000
5000

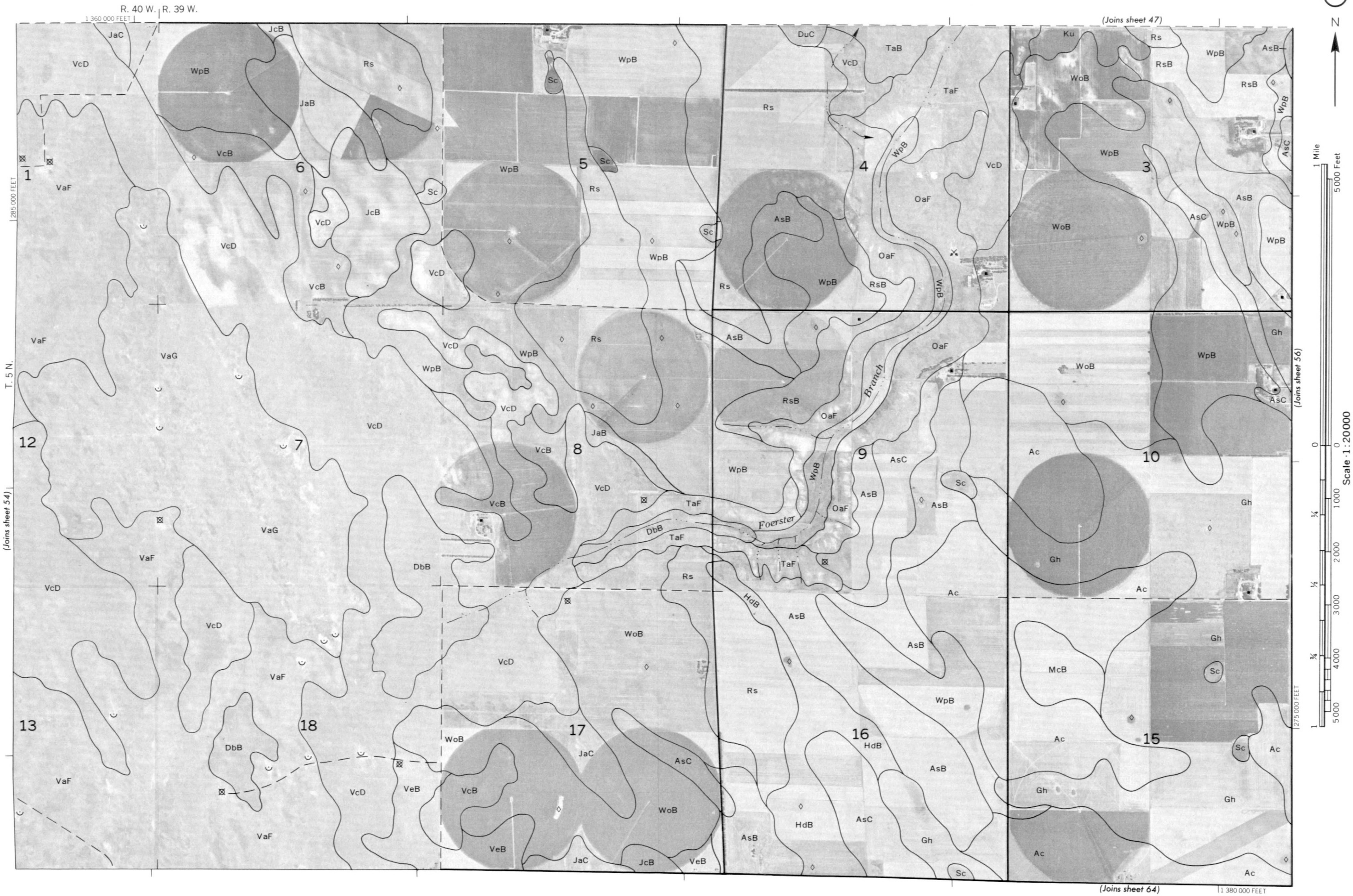

N
(Joins sheet 41)
R. 37 W.
1 450 000 FEET
(Joins sheet 49)
(Joins sheet 51)
(Joins sheet 58)
T. 6 N.
1 430 000 FEET
300 000 FEET
290 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
0
1000
2000
3000
4000
5000
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
BURLINGTON
NORTHERN
Enders
ENDERS
RESERVOIR
STATE
SPECIAL
USE
AREA
ENDERS
RESERVOIR
Enders
Dam
Airport
6
61
McB
Ku
RtC
AsC
AsB
Gh
RtB
CrB
CrC
CrD
HdB
RsB
ChF
Sc
KeB
KuB
KuC
UsD2
ChG
ChF
VcB
VcD
ChD
VaF
JcB
JcC
Gb
WpB
OaF
SaD
VaF

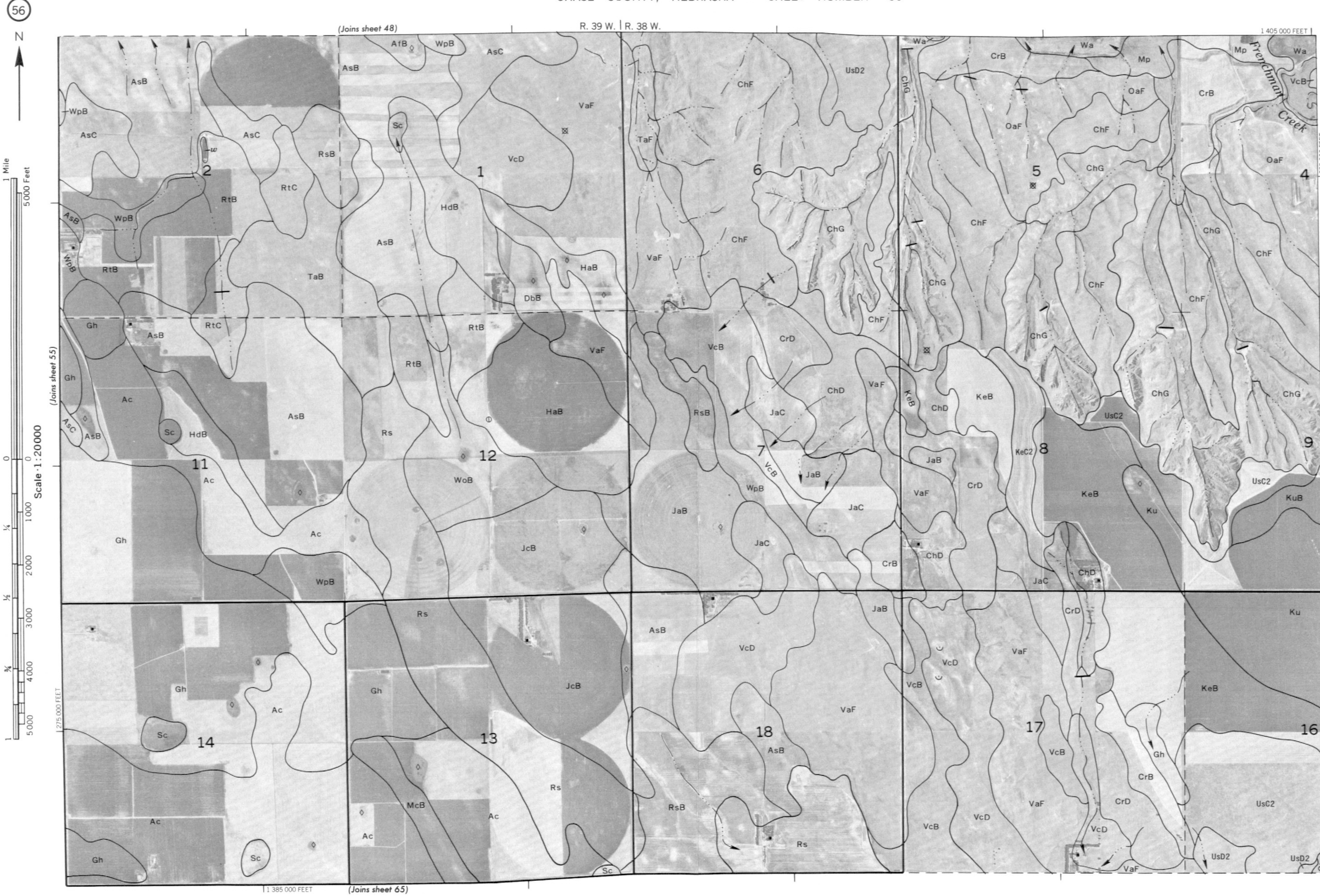

51
1 455 000 FEET
R. 37 W.
R. 36 W.
(Joins sheet 42)
(Joins sheet 50)
(Joins inset, sheet 43)
(Joins sheet 59)
1 475 000 FEET
300 000 FEET
290 000 FEET
T. 6 N.
N
Scale 1:20000
1 Mile
5000 Feet
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36
ChG
ChF
ChD
OaG
Ku
KuB
UsD2


N
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
Scale 1:20000
(Joins sheet 44)
R. 42 W.
R. 41 W.
1 310 000 FEET
290 000 FEET
T. 5 N.
(Joins sheet 53)
(Joins sheet 61)
1 290 000 FEET
275 000 FEET
COLORADO
YUMA COUNTY
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18
VaF
VcD
VaG
HaB
JcB
HdB
DbB
JcC
JaB
LaB
JaC
CrB

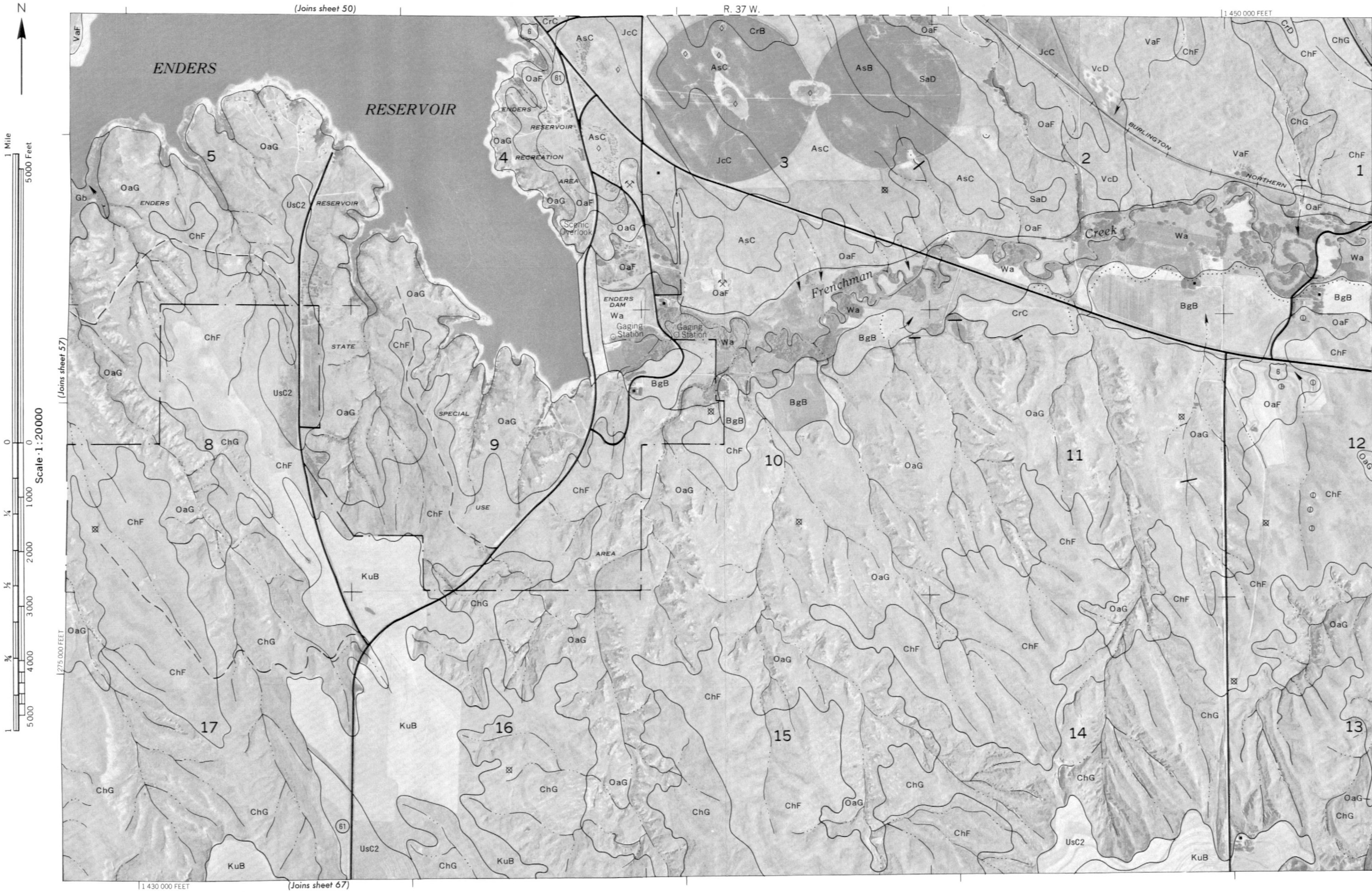

53
N
(Joins sheet 45)
R. 41 W.
R. 40 W.
(Joins sheet 54)
(Joins sheet 52)
(Joins sheet 62)
T. 5 N.
1 315 000 FEET
290 000 FEET
275 000 FEET
1 330 000 FEET
1 Mile
5000 Feet
Scale 1:20000
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18
JaB
JaC
JcB
JcC
VaF
VaG
VcB
VcD
WoB
WpB
RsB
DbB
HaB
CrB
CrC
LaB

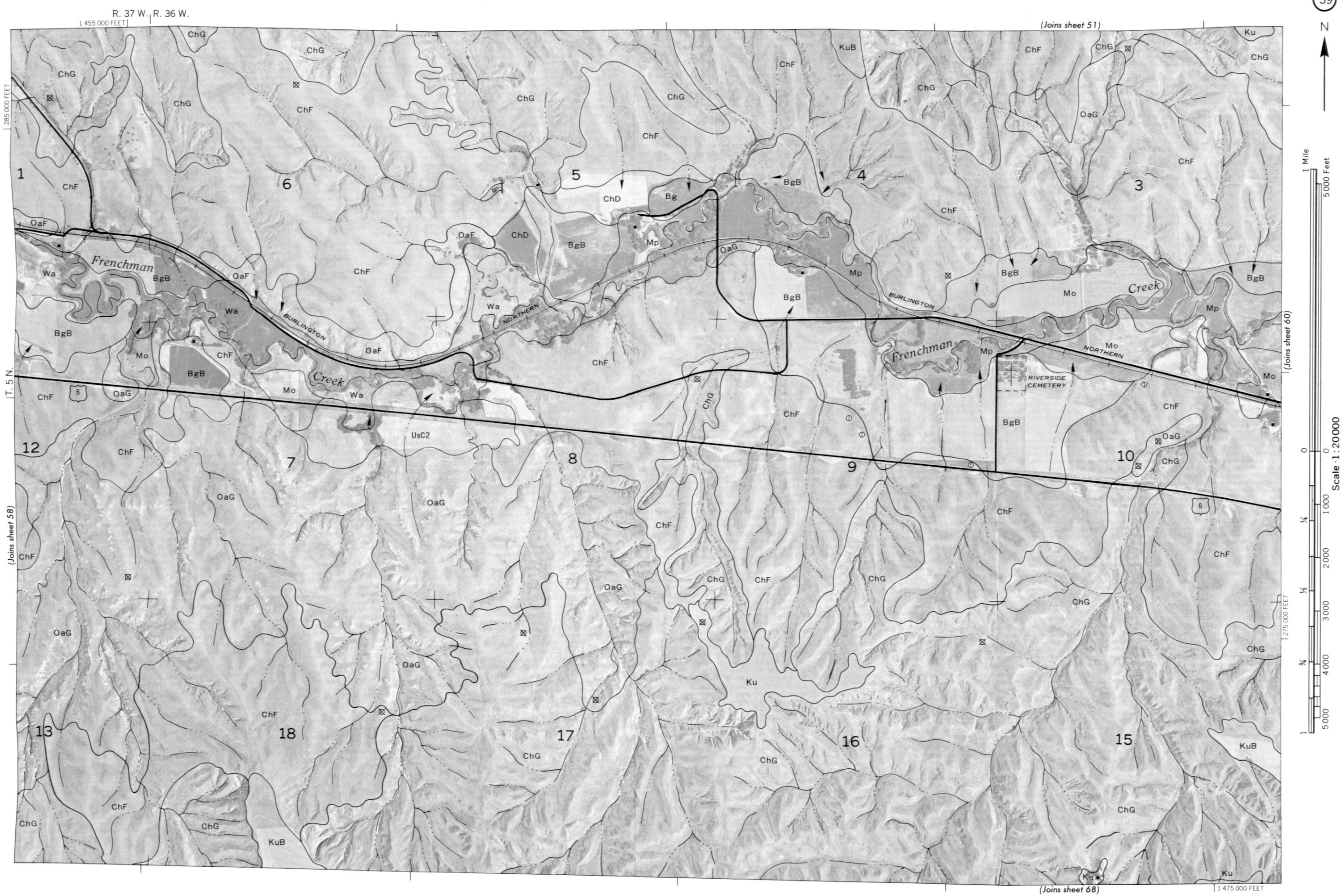

N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
0
¼
½
¾
1
(Joins sheet 46)
R. 40 W.
1 355 000 FEET
285 000 FEET
T. 5 N.
(Joins sheet 55)
(Joins sheet 53)
275 000 FEET
1 335 000 FEET
(Joins sheet 63)
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
HaB VcB WoB VcB WoB WpB VcD WpB VcD VcB WoB JaB JaB JaB VcB VcD DbB VcD VaF HaB
JcB VcD VcD JaB WoB VcB VcD VcD WpB VcB VcD WoB VaF
VcD VcB VcD WoB VcD WoB VcB VcD VcD VcB WoB JaB WpB VcD
WpB VaF VcB VcD VeB VcD VaF AsB HaB WoB WoB VcD BeB HdB
VaF VcD VaF VcD VcD VcB VcB VcD AsB VcD HaB VaF VaG VaF HdB RtC
VcB VcD HaB WpB VcD DbB VaF VcD VcB VcD HdB WpB VcB VaF DbB VaF VaF VcD
VcB VaF TaB VcB VcD HaB VcB VcD VcB VcB HdB VcD VaG VaF VaF HaB VcD
HaB VcD VaF VcD VcB VcD VcD VaF VcD HaB VcB HaB VcB HaB

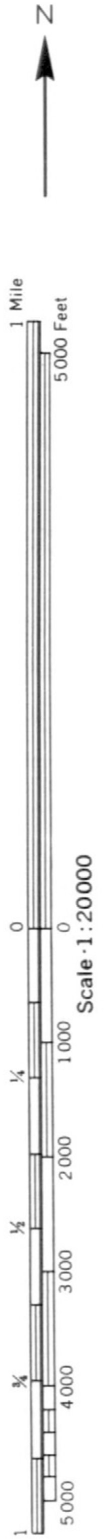

55
R. 40 W.
R. 39 W.
1 360 000 FEET
(Joins sheet 47)
(Joins sheet 54)
(Joins sheet 56)
(Joins sheet 64)
1 380 000 FEET
285 000 FEET
275 000 FEET
T. 5 N.
N
Foerster
Branch
1 Mile
5000 Feet
Scale 1:20000

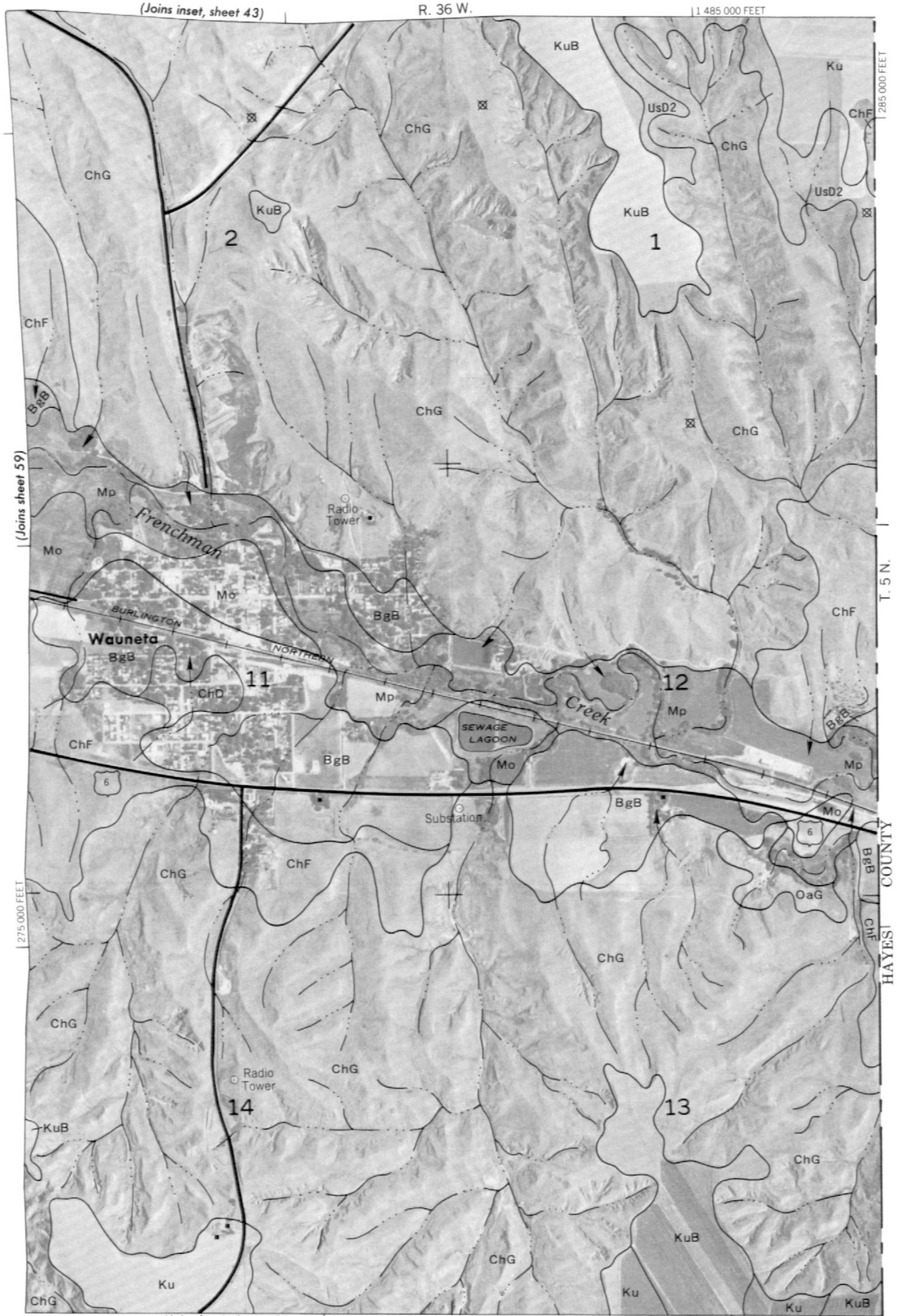

56
N
(Joins sheet 48)
R. 39 W. | R. 38 W.
1 405 000 FEET
285 000 FEET
T. 5 N.
(Joins sheet 57)
(Joins sheet 55)
(Joins sheet 65)
1 385 000 FEET
275 000 FEET
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
Frenchman Creek
1
2
4
5
6
7
8
9
11
12
13
14
16
17
18


N
1 410 000 FEET
R. 38 W. | R. 37 W.
(Joins sheet 49)
285 000 FEET
T. 5 N.
(Joins sheet 56)
(Joins sheet 58)
275 000 FEET
1 425 000 FEET
(Joins sheet 66)
Scale 1:20000
1 Mile
5000 Feet
Frenchman Creek
Gaging Station
ENDERS RESERVOIR STATE SPECIAL USE AREA
CHURCH GROVE RECREATION AREA
ENDERS RESERVOIR
1
2
3
4
6
7
9
10
11
12
13
14
15
16
18
Wa
VcB
VaF
VcD
CrB
OaF
OaG
ChF
ChG
UsC2
KuB
Ku
KeB
Gh
Sc
ChD
Gb
TaF
Fu

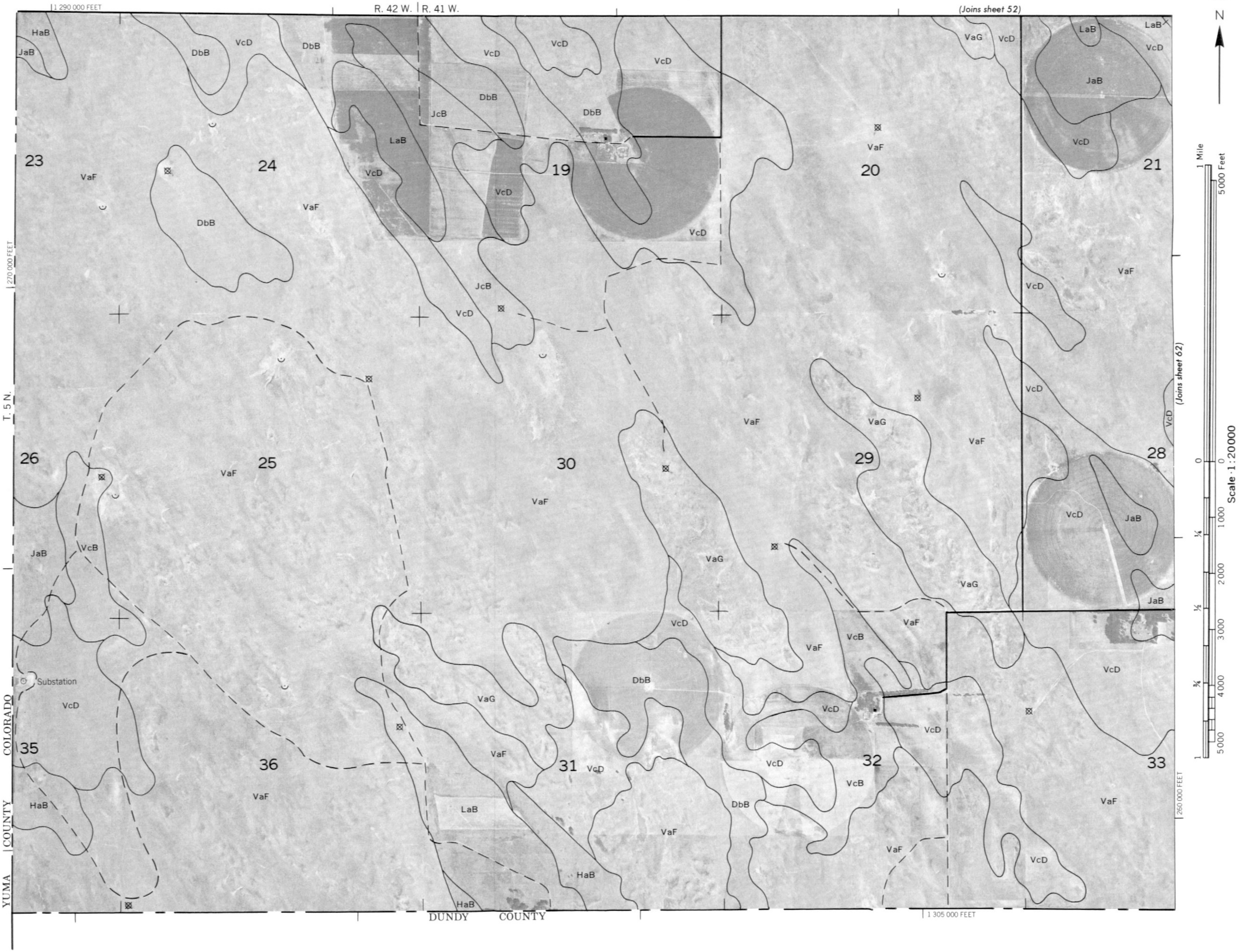

N
1 Mile
5 000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
(Joins sheet 50)
R. 37 W.
1 450 000 FEET
285 000 FEET
(Joins sheet 57)
(Joins sheet 59)
T. 5 N.
275 000 FEET
1 430 000 FEET
(Joins sheet 67)
ENDERS
RESERVOIR
ENDERS RESERVOIR RECREATION AREA
ENDERS RESERVOIR
STATE SPECIAL USE AREA
Scenic Overlook
ENDERS DAM
Gaging Station
Gaging Station
Frenchman
Creek
BURLINGTON
NORTHERN
6
61
1
2
3
4
5
8
9
10
11
12
13
14
15
16
17
VaF
OaG
OaF
Gb
ChF
ChG
UsC2
CrC
AsC
JcC
CrB
AsB
SaD
JcC
VcD
CrD
SaD
Wa
BgB
CrC
KuB
OaG
ChG
KuB
UsC2

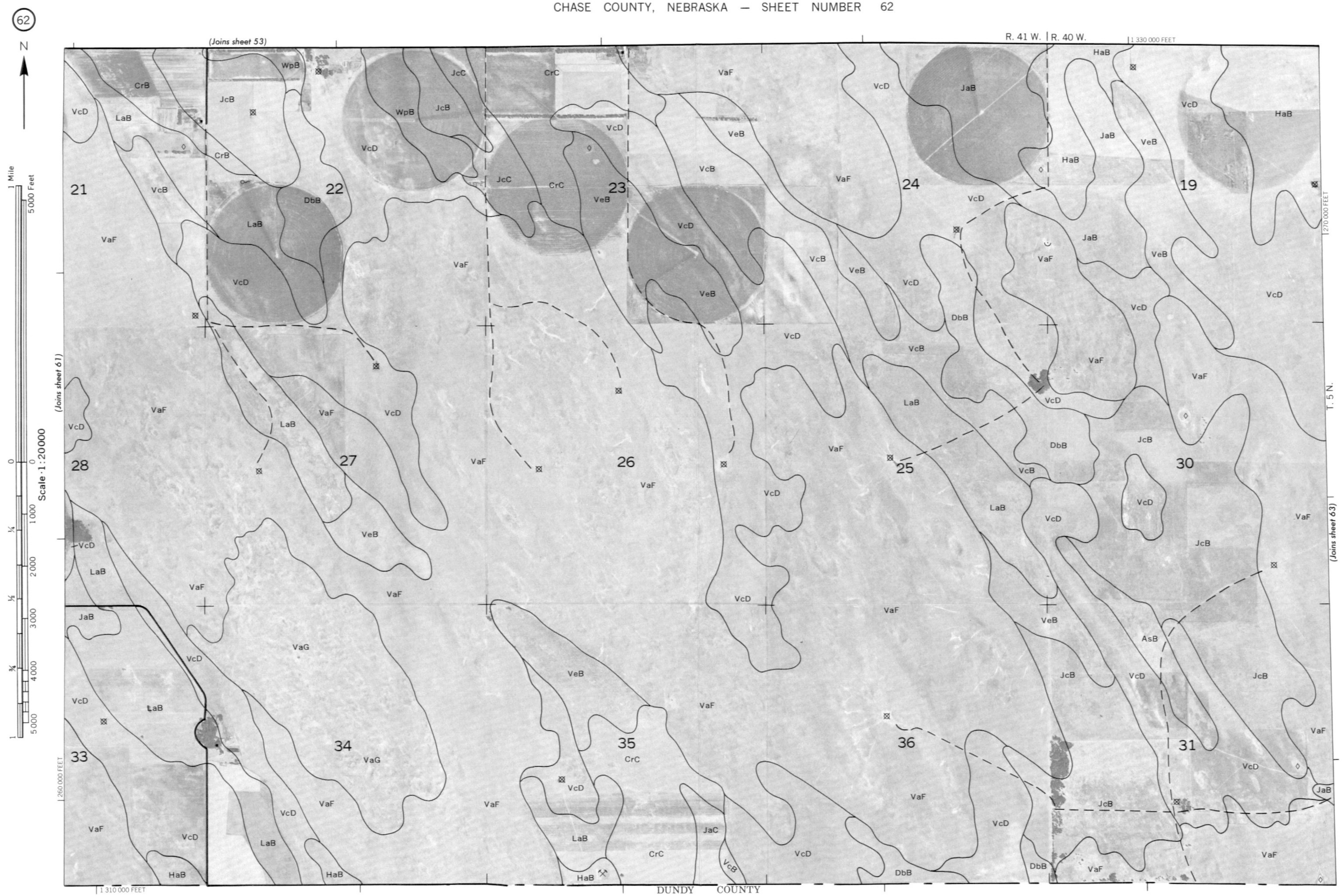

59
N
R. 37 W. | R. 36 W.
1 455 000 FEET
285 000 FEET
275 000 FEET
1 475 000 FEET
(Joins sheet 51)
(Joins sheet 58)
(Joins sheet 60)
(Joins sheet 68)
T. 5 N.
Frenchman
Creek
Frenchman
Creek
BURLINGTON
NORTHERN
BURLINGTON
NORTHERN
RIVERSIDE CEMETERY
6
6
1
3
4
5
6
7
8
9
10
12
13
15
16
17
18
ChG
ChF
ChD
OaF
OaG
BgB
Bg
Wa
Mo
Mp
UsC2
Ku
KuB
1 Mile
5000 Feet
Scale 1:20 000
0
¼
½
¾
1
0
1000
2000
3000
4000
5000

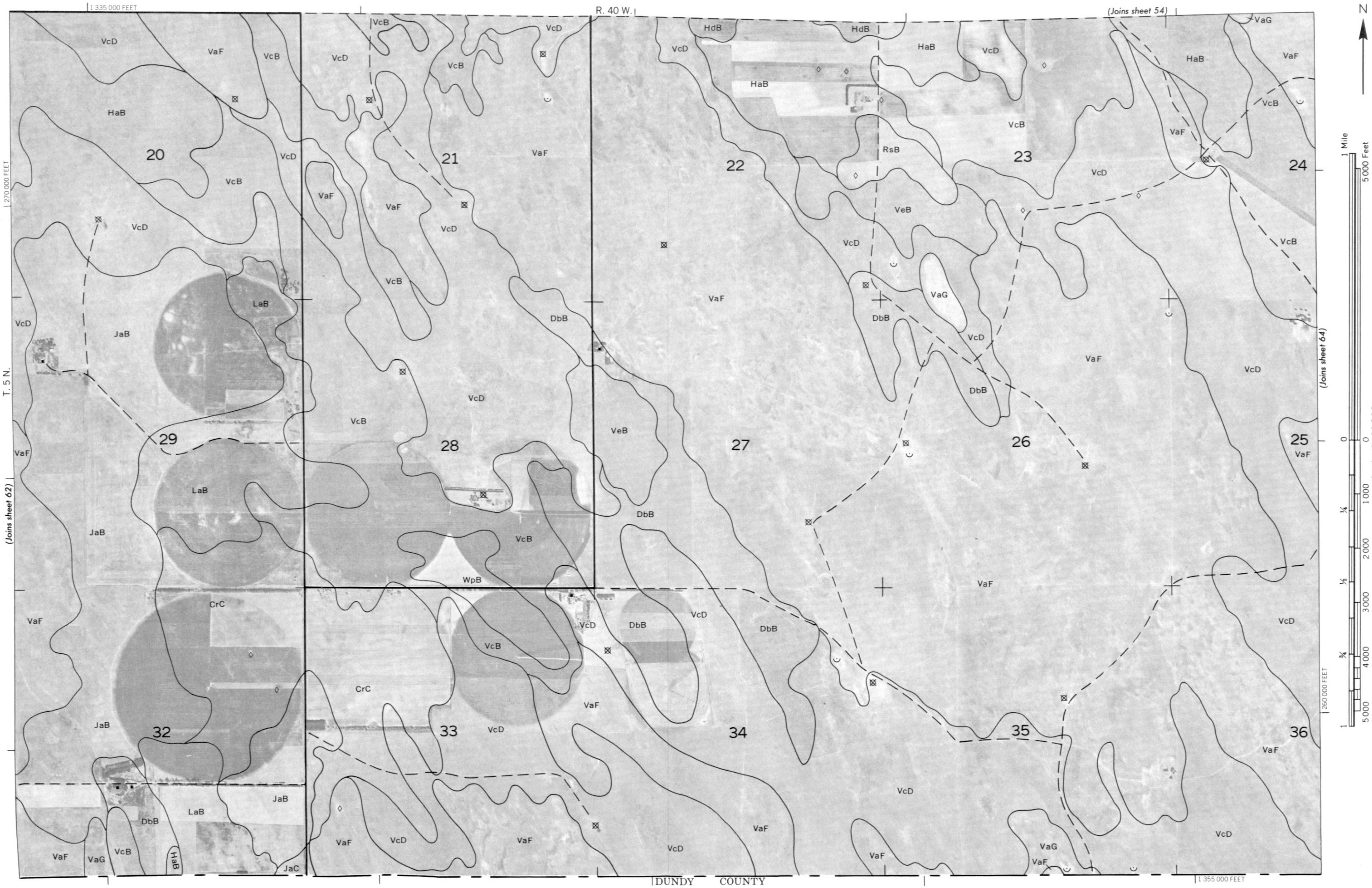

N
1 Mile
5000 Feet
Scale 1:20000
0
¼
½
¾
1
0
1000
2000
3000
4000
5000

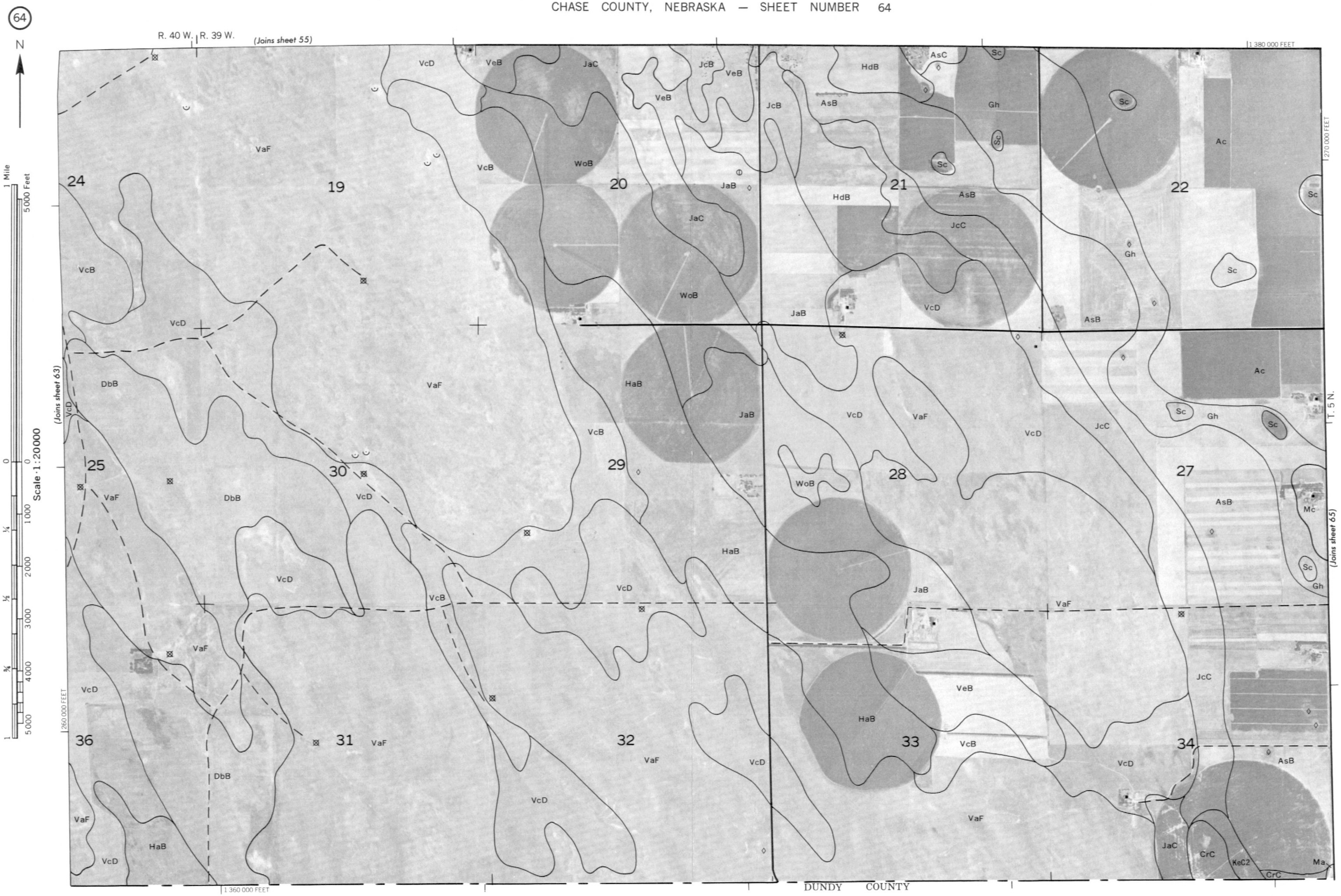

(Joins inset, sheet 43)
R. 36 W.
1 485 000 FEET
285 000 FEET
(Joins sheet 59)
T. 5 N.
275 000 FEET
(Joins inset, sheet 60)
1 480 000 FEET
HAYES COUNTY
KuB
Ku
UsD2
ChG
ChF
USD2
2
1
ChF
BgB
Mp
Frenchman
Radio Tower
Mo
BURLINGTON
NORTHERN
Wauneta
BgB
ChD
11
12
Creek
Mp
SEWAGE LAGOON
Mo
BgB
Substation
OaG
ChG
Radio Tower
14
13
KuB
Ku
ChG

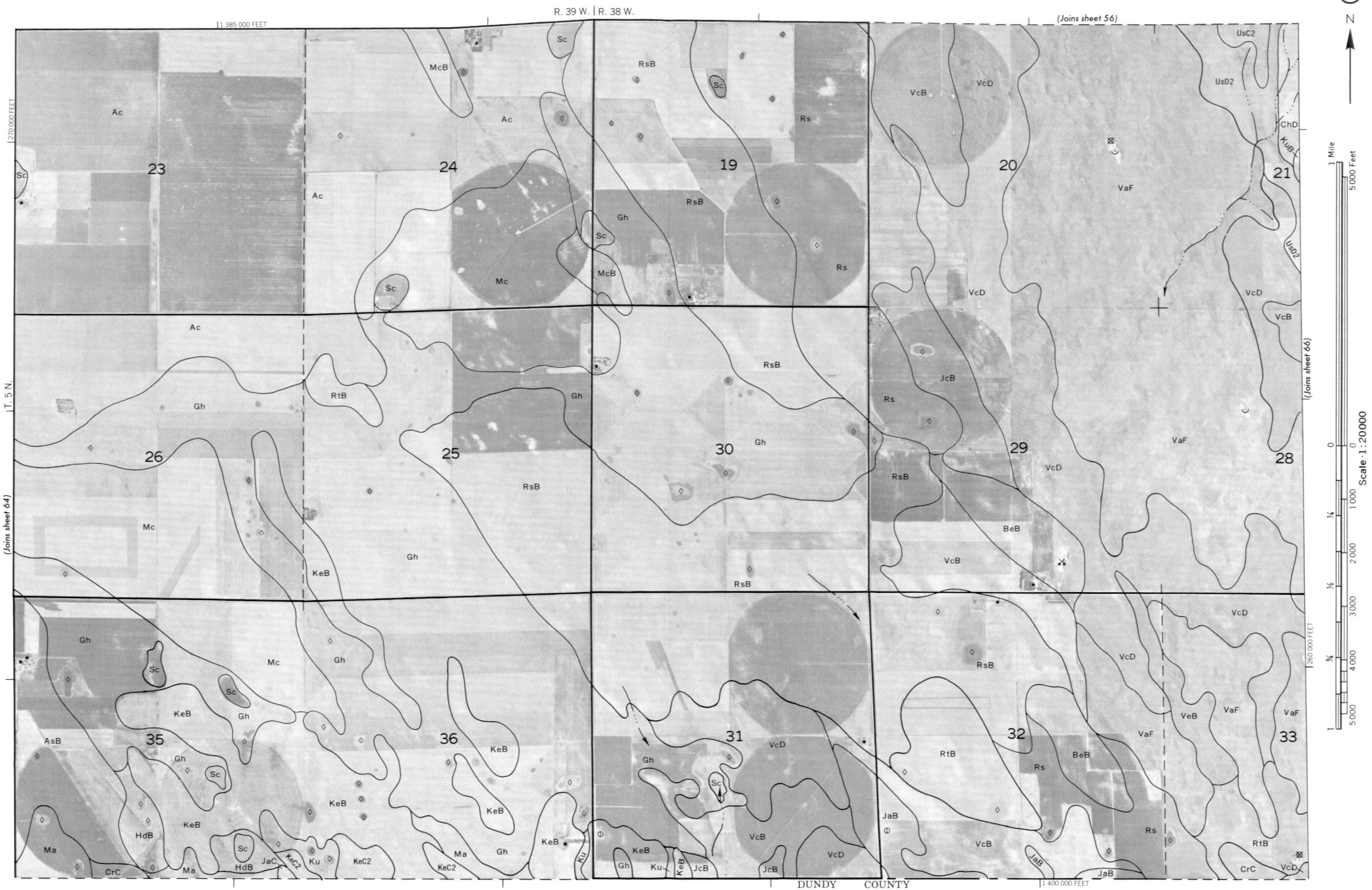

(Joins sheet 60)
R. 36 W.
1 485 000 FEET
270 000 FEET
(Joins sheet 68)
T. 5 N.
255 000 FEET
1 480 000 FEET
DUNDY COUNTY
HAYES COUNTY
ChG
Ku
KuB
23
24
UsC2
Canyon
26
25
ChD
ChF
Horse
35
36
KeB
ChF

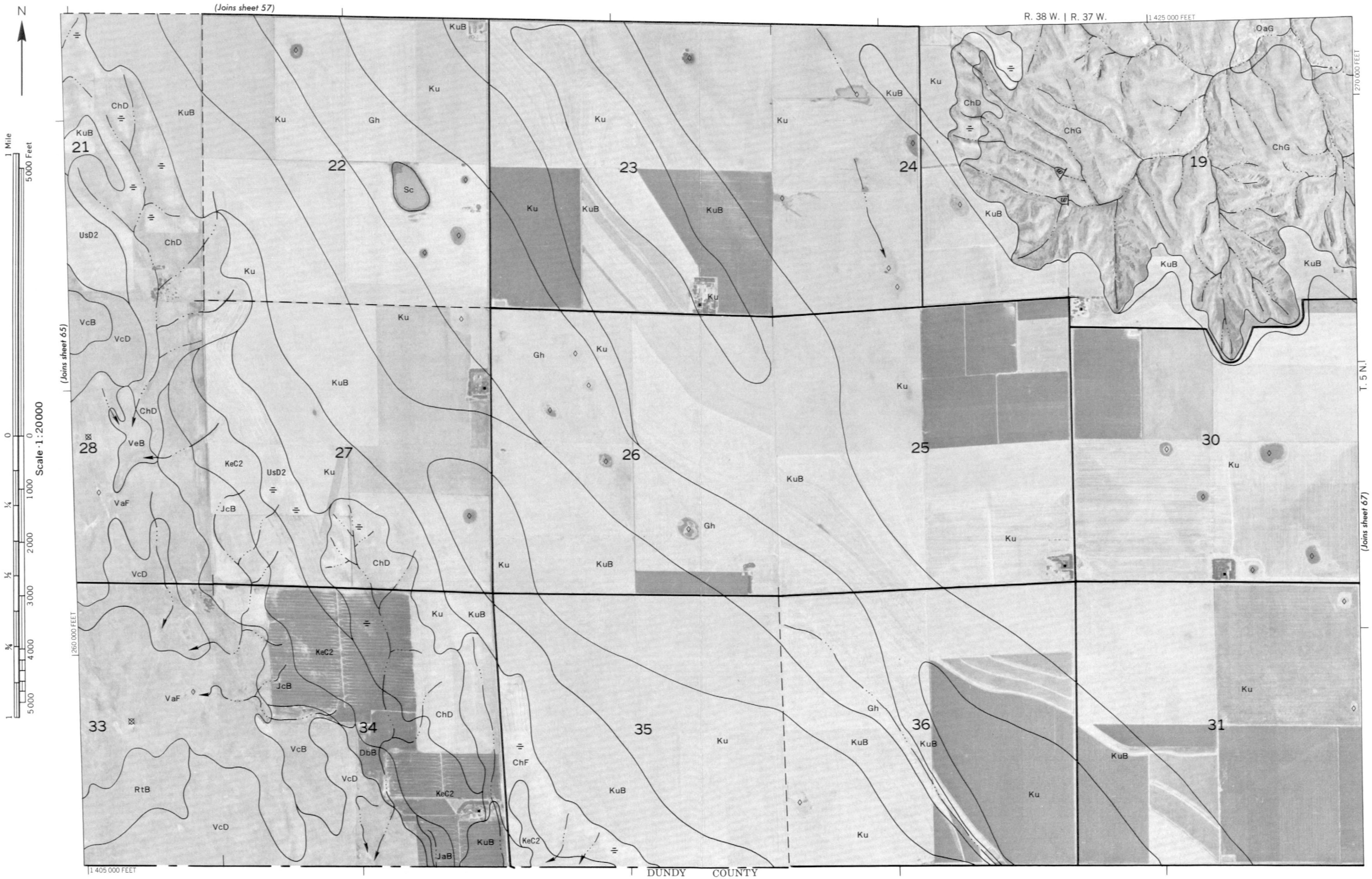

1 290 000 FEET
R. 42 W.
R. 41 W.
(Joins sheet 52)
N
HaB
JaB
DbB
VcD
DbB
VcD
VcD
VcD
DbB
JcB
DbB
LaB
VcD
VcD
VaG
VcD
LaB
LaB
VcD
JaB
VcD
23
VaF
24
VaF
DbB
19
20
VaF
21
VcD
VcD
VaF
220 000 FEET
JcB
VcD
VcD
T. 5 N.
VcD
(Joins sheet 62)
VaF
VaG
VaF
VcD
26
VaF
25
30
VaF
29
28
VcD
JaB
JaB
VcB
VaG
VaG
JaB
VcD
VaF
VcB
VaF
VcD
Substation
DbB
VaG
VcD
VcD
VcD
35
VaF
31
VcD
VcD
32
33
36
VcB
VaF
HaB
LaB
DbB
VaF
VaF
VaF
VcD
HaB
HaB
COLORADO
YUMA COUNTY
DUNDY COUNTY
1 305 000 FEET
260 000 FEET
1 Mile
5000 Feet
Scale 1:20000


62
N
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
(Joins sheet 53)
(Joins sheet 61)
(Joins sheet 63)
R. 41 W.
R. 40 W.
1 330 000 FEET
270 000 FEET
260 000 FEET
1 310 000 FEET
T. 5 N.
DUNDY COUNTY
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31
CrB
VcD
LaB
WpB
JcB
CrB
VcB
DbB
LaB
VcD
VaF
JcC
WpB
JcB
VcD
CrC
JcC
CrC
VcD
VeB
VaF
VeB
VcB
VcD
VeB
VcD
VaF
JaB
HaB
JaB
VeB
HaB
VcD
HaB
VcD
JaB
VaF
VeB
VcB
VeB
VcD
DbB
VcB
VcD
VaF
VcD
VaF
LaB
VaF
VcD
LaB
VaF
VcD
VeB
VaF
VaF
VaF
VcD
VaF
LaB
DbB
VcB
VcD
JcB
VcD
LaB
VcD
VaF
JcB
VaF
JaB
VaG
VcD
VcD
LaB
VaG
VeB
VaF
VcD
VeB
AsB
JcB
VcD
JcB
VaF
CrC
VcD
VaF
VaF
VaF
VcD
JaB
JcB
VaF
VcD
LaB
LaB
JaC
CrC
VcB
VcD
VcD
HaB
HaB
HaB
DbB
DbB
VaF
VaF


R. 40 W.
(Joins sheet 54)
(Joins sheet 62)
(Joins sheet 64)
T. 5 N.
DUNDY COUNTY
1 335 000 FEET
270 000 FEET
260 000 FEET
1 355 000 FEET
N
20
21
22
23
24
29
28
27
26
25
32
33
34
35
36
VcD
VaF
VcB
HaB
HdB
VaG
RsB
VeB
DbB
LaB
JaB
CrC
WpB
JaC
Scale 1:20000
1 Mile
5000 Feet
0
¼
½
¾
1
1000
2000
3000
4000
5000


N
R. 40 W.
R. 39 W.
(Joins sheet 55)
1 380 000 FEET
270 000 FEET
T. 5 N.
(Joins sheet 63)
(Joins sheet 65)
260 000 FEET
1 360 000 FEET
DUNDY COUNTY
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
¼
½
¾
1
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36
VcD
VeB
JaC
JcB
AsC
Sc
HdB
AsB
JcB
Gh
Ac
VaF
VcB
WoB
JaB
JcC
VcD
DbB
HaB
Mc
CrC
KeC2
Ma


65
N
R. 39 W. | R. 38 W.
(Joins sheet 56)
(Joins sheet 64)
(Joins sheet 66)
T. 5 N.
1 385 000 FEET
270 000 FEET
260 000 FEET
1 400 000 FEET
DUNDY COUNTY
Scale 1:20000
1 Mile
5000 Feet
23
24
19
20
21
26
25
30
29
28
35
36
31
32
33
Ac
Sc
McB
Mc
Gh
RsB
Rs
RtB
KeB
Ma
HdB
CrC
JaC
KeC2
Ku
AsB
JcB
VcB
VcD
VaF
UsC2
UsD2
ChD
KuB
JcB
BeB
VeB
JaB
RtB
CrC


N
(Joins sheet 57)
(Joins sheet 65)
(Joins sheet 67)
R. 38 W. | R. 37 W.
1 425 000 FEET
270 000 FEET
260 000 FEET
1 405 000 FEET
T. 5 N.
DUNDY COUNTY
1 Mile
5000 Feet
Scale 1:20000
0
1000
2000
3000
4000
5000
21
22
23
24
19
28
27
26
25
30
33
34
35
36
31
KuB
Ku
Gh
ChD
ChG
OaG
Sc
UsD2
VcB
VcD
VeB
VaF
KeC2
JcB
DbB
RtB
ChF
JaB


67
N
(Joins sheet 58)
R. 37 W.
1 430 000 FEET
270 000 FEET
T. 5 N.
(Joins sheet 66)
(Joins sheet 68)
260 000 FEET
1 450 000 FEET
DUNDY COUNTY
1 Mile
5 000 Feet
Scale 1:20000
20
21
22
23
24
25
26
27
28
29
32
33
34
35
36
ChG
ChF
KuB
KuC
Ku
UsC2
UsD2
OaG
Sc
KeB
KeC2
Gh
61


N
R. 37 W. | R. 36 W.
(Joins sheet 59)
(Joins sheet 67)
(Joins inset, sheet 60)
T. 5 N.
1 475 000 FEET
270 000 FEET
260 000 FEET
1 455 000 FEET
DUNDY COUNTY
Scale 1:20000
1 Mile
5000 Feet
0
1000
2000
3000
4000
5000
ChF
ChG
KuB
Ku
KeB
Sc
Gh
19
20
21
22
24
25
27
28
29
30
31
32
33
34
36